

APPENDIX

RECOMMENDED SAFETY AND HANDLING PROCEDURES
FOR LABORATORIES CONDUCTING PCDD/PCDF ANALYSES

Recommended Safety and Handling Procedures in Connection with Implementing
the Analytical Protocol for Determination of PCDD/PCDF in Combustion Products

1. The human toxicology of PCDD/PCDF is not well defined at present, although the 2,3,7,8-TCDD isomer has been found to be acnegenic, carcinogenic, and teratogenic in the course of laboratory animal studies. The 2,3,7,8-TCDD is a solid at room temperature, and has a relatively low vapor pressure. The solubility of this compound in water is only about 200 parts-per-trillion, but the solubility in various organic solvents ranges from about 0.001% to 0.14%. The physical properties of the 135 other tetra-through octachlorinated PCDD/PCDF have not been well established, although it is presumed that the physical properties of these congeners are generally similar to those of the 2,3,7,8-TCDD isomer. On the basis of the available toxicological and physical property data for TCDD, this compound, as well as the other PCDD and PCDF, should be handled only by highly trained personnel who are thoroughly versed in the appropriate procedures, and who understand the associated risks.

2. PCDD/PCDF and samples containing these are handled using essentially the same techniques as those employed in handling radioactive or infectious materials. Well-ventilated, controlled-access laboratories are required, and laboratory personnel entering these laboratories should wear appropriate safety clothing, including disposable coveralls, shoe covers, gloves, and face and head masks. During analytical operations which may give rise to aerosols or dusts, personnel should wear respirators equipped with activated carbon filters. Eye protection equipment (preferably full face shields) must be worn at all times while working in the analytical laboratory with PCDD/PCDF. Various types of gloves can be used by personnel, depending upon the analytical operation being accomplished. Latex gloves are generally utilized, and when handling samples thought to be particularly hazardous, an additional set of gloves is also worn beneath the latex gloves (for example, Playtex gloves supplied by American Scientific Products, Cat. No. 67216). Bench-tops and other work surfaces in the laboratory should be covered with plastic-backed absorbent paper during all analytical processing. When finely divided samples (dusts, soils, dry chemicals) are being processed, removal of these from sample containers, as well as other operations, including weighing, transferring, and mixing with solvents, should all be accomplished within a glove box. Glove boxes, hoods and the effluents from mechanical vacuum pumps and gas chromatographs on the mass spectrometers should be vented to the atmosphere preferably only after passing through HEPA particulate filters and vapor-sorbing charcoal.

3. All laboratory ware, safety clothing and other items potentially contaminated with PCDD/PCDF in the course of analyses must be carefully secured and subjected to proper disposal. When feasible, liquid wastes

are concentrated, and the residues are placed in approved steel hazardous waste drums fitted with heavy gauge polyethylene liners. Glass and combustible items are compacted using a dedicated trash compactor used only for hazardous waste materials and then placed in the same type of disposal drum. Disposal of accumulated wastes is periodically accomplished by high temperature incineration at EPA-approved facilities.

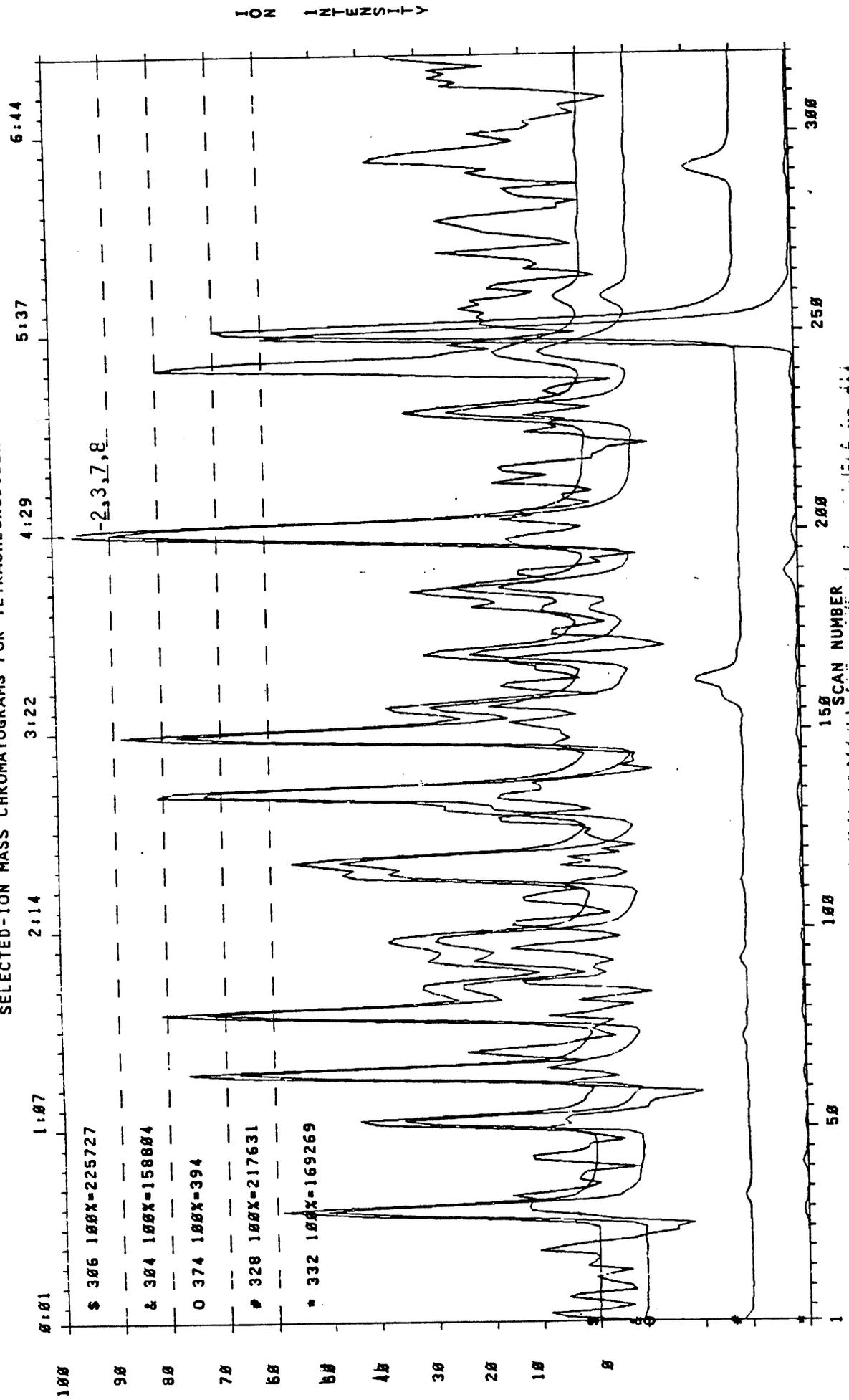
4. Surfaces of laboratory benches, apparatus and other appropriate areas should be periodically subjected to surface wipe tests using solvent-wetted filter paper which is then analyzed to check for PCDD/PCDF contamination in the laboratory. Typically, if the detectable level of TCDD or TCDF from such a test is greater than $50\text{ng}/\text{m}^2$, this indicates the need for decontamination of the laboratory. A typical action limit in terms of surface contamination of the other PCDD/PCDF (summed) is $500\text{ng}/\text{m}^2$. In the event of a spill within the laboratory, absorbent paper is used to wipe up the spilled material and this is then placed into a hazardous waste drum. The contaminated surface is subsequently cleaned thoroughly by washing with appropriate solvents (methylene chloride followed by methanol) and laboratory detergents. This is repeated until wipe tests indicate that the levels of surface contamination are below the limits cited.

5. In the unlikely event that analytical personnel experience skin contact with PCDD/PCDF or samples containing these, the contaminated skin area should immediately be thoroughly scrubbed using mild soap and water. Personnel involved in any such accident should subsequently be taken to the nearest medical facility, preferably a facility whose staff is knowledgeable in the toxicology of chlorinated hydrocarbons. Again, disposal of contaminated clothing is accomplished by placing it in hazardous waste drums.

6. It is desirable that personnel working in laboratories where PCDD/PCDF are handled be given periodic physical examinations (at least yearly). Such examinations should include specialized tests, such as those for urinary porphyrins and for certain blood parameters which, based upon published clinical observations, are appropriate for persons who may be exposed to PCDD/PCDF. Periodic facial photographs to document the onset of dermatologic problems are also advisable.



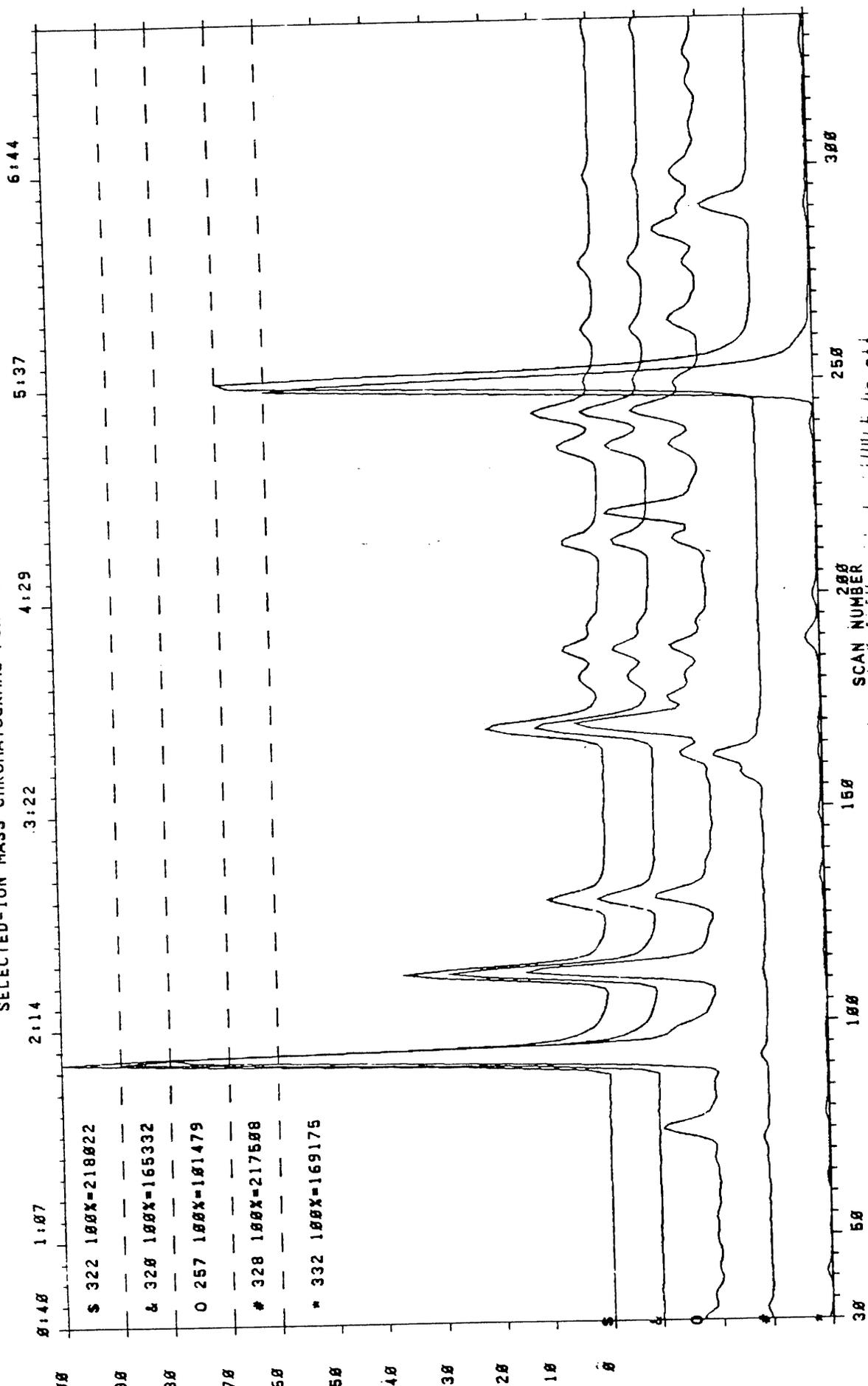
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 02/21/84 TIME: 15:02
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR40037, WSU NAME: CHJ-2.10.11.35, 1, 34
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1
 FIGURE: 42

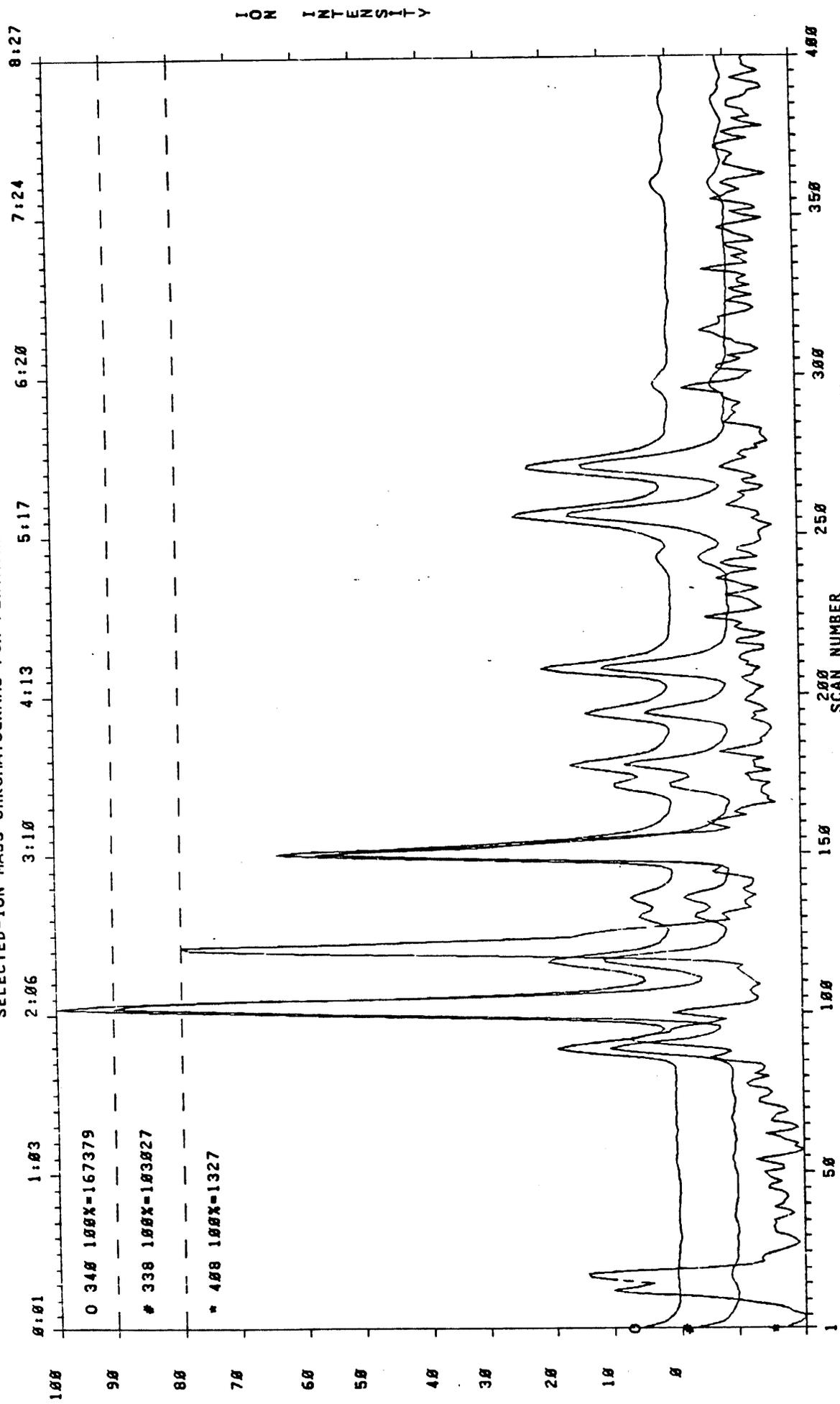
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:02
KRATOS MS25, DS55 SOFTWARE, RUN: TOR40037, WSU NAME: CHJ-2,10,11,35, 1, 34
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



HRGC-LAMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1
FIGURE: 43

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 02/21/84 TIME: 15:11
 KRATOS MS25, DS55 SOFTWARE, RUN: TORS0030, WSU NAME: CHJ.2.10.11.35 1, 34
 SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



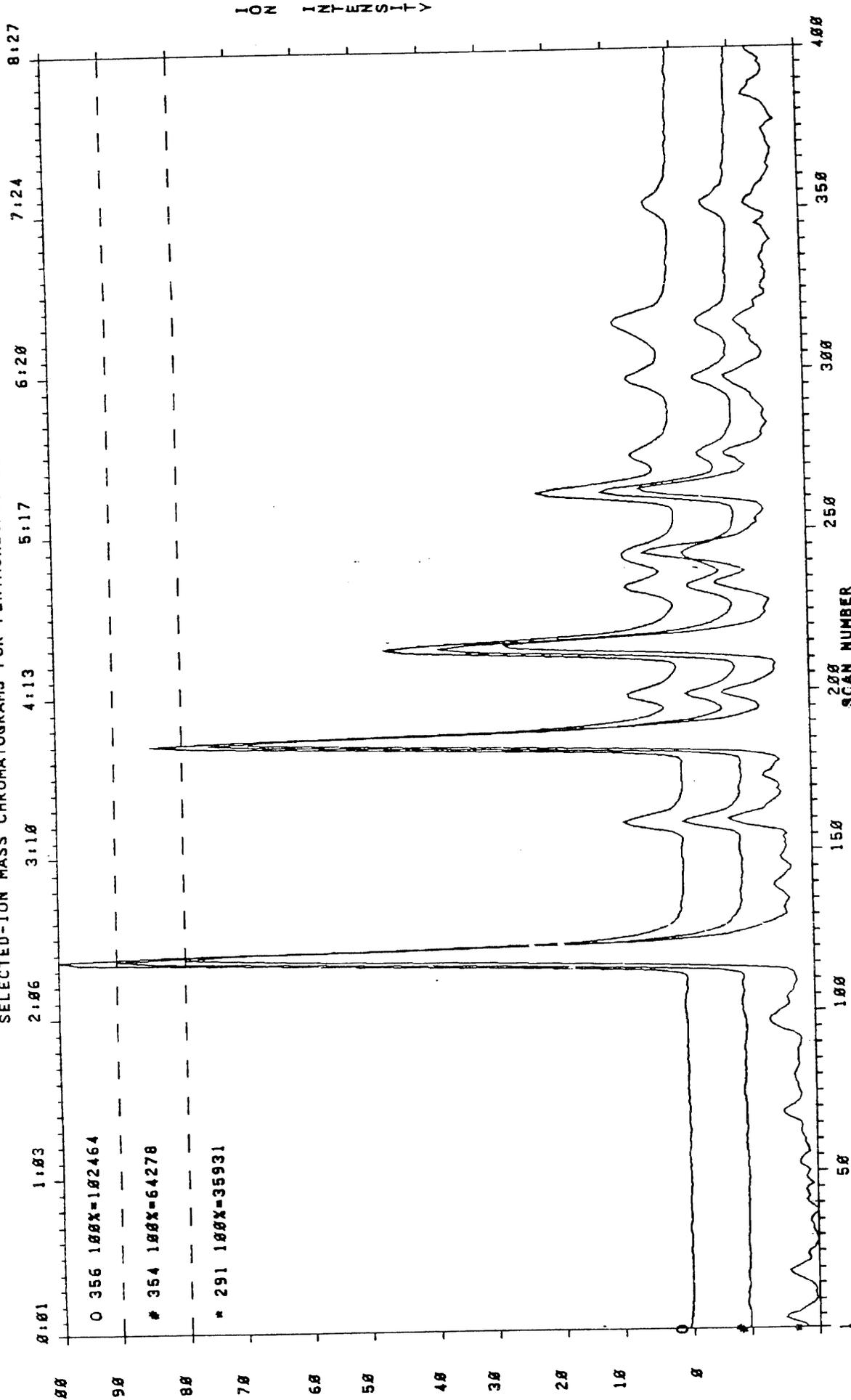
200 SCAN NUMBER
 400 350 300 250 200 150 100 50 1
 REC-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1
 FIGURE: 44

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:11

KRATOS MS25, DS55 SOFTWARE, RUN: TOR50030, WSU NAME: CHJ-2.10,11.35, 1, 34

SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS

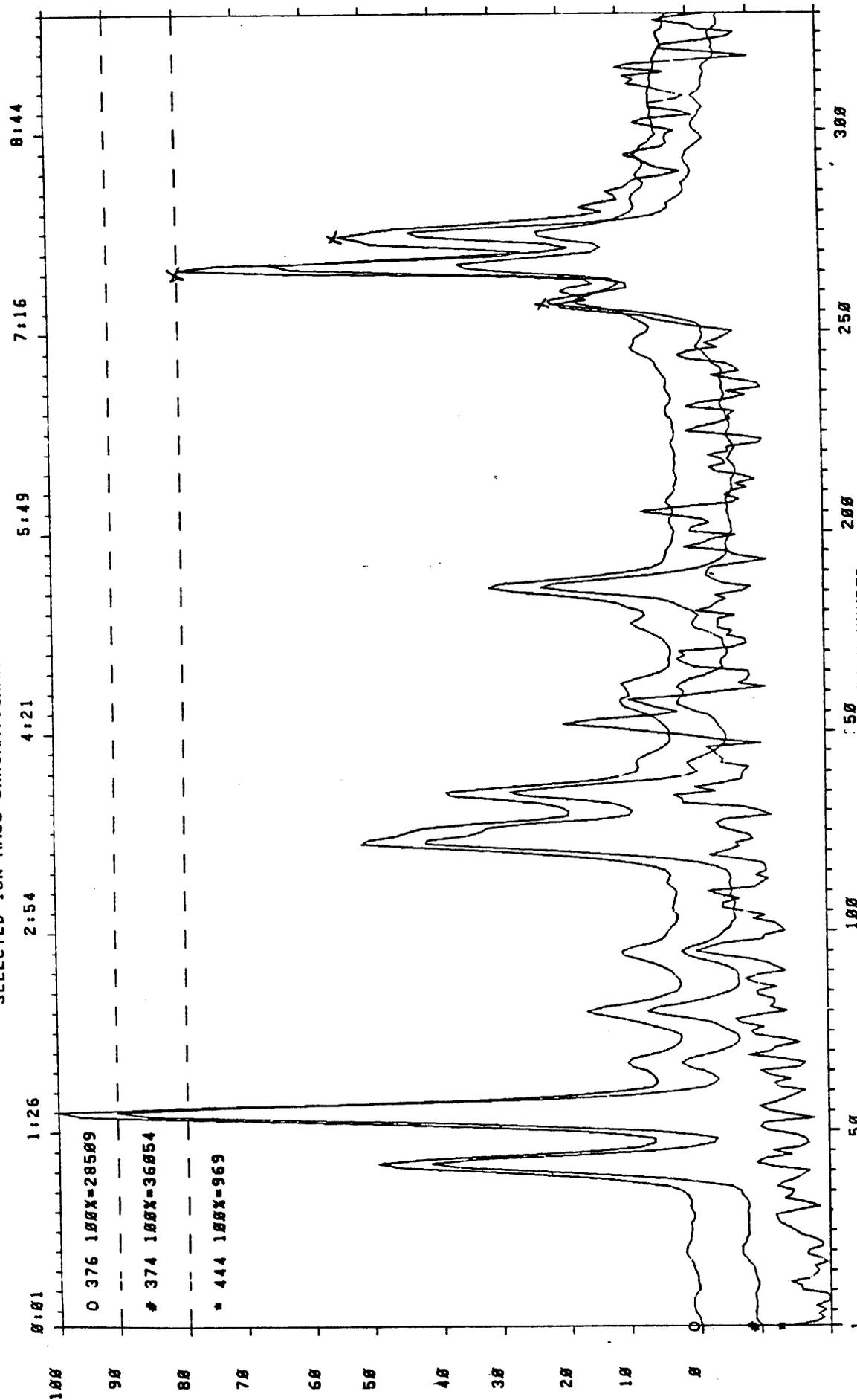


HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A1
FIGURE: 45

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:21

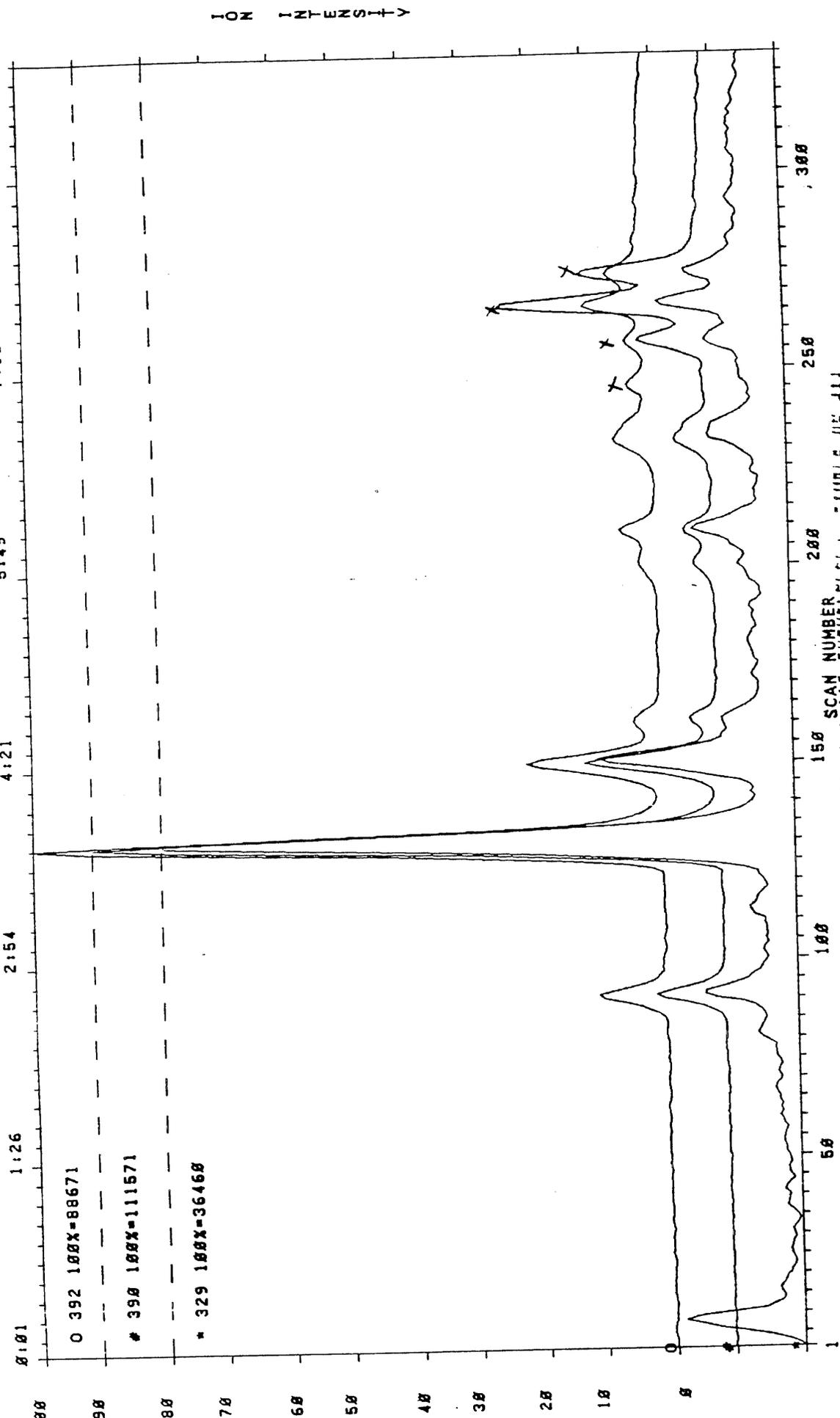
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60032, WSU NAME: CHJ-2,10,11,34, 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1
FIGURE: 46

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

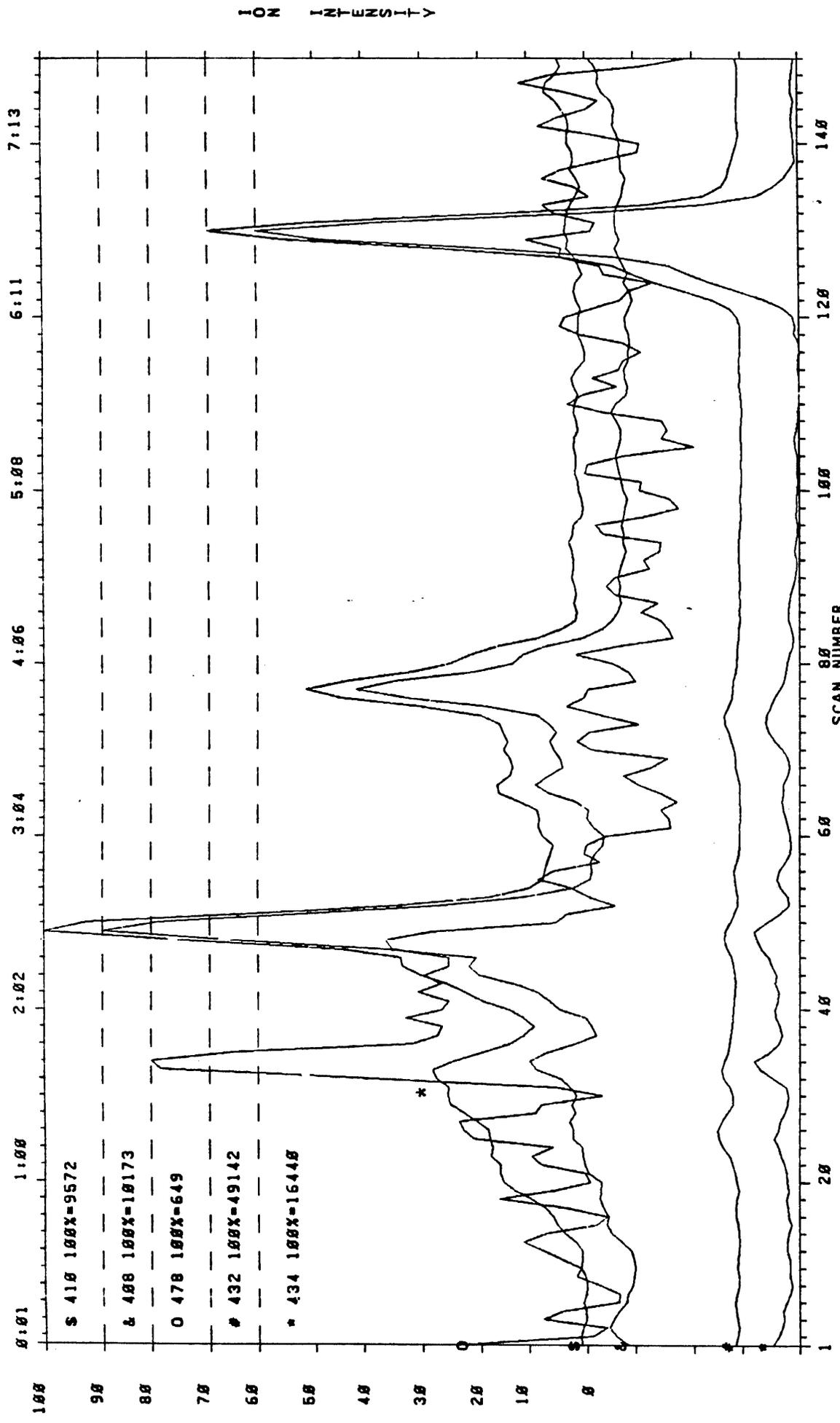
DATE: 02/21/84 TIME: 15:21
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60032, WSU NAME: CHJ-2,10,11,34, 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 2A1
FIGURE: 47

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

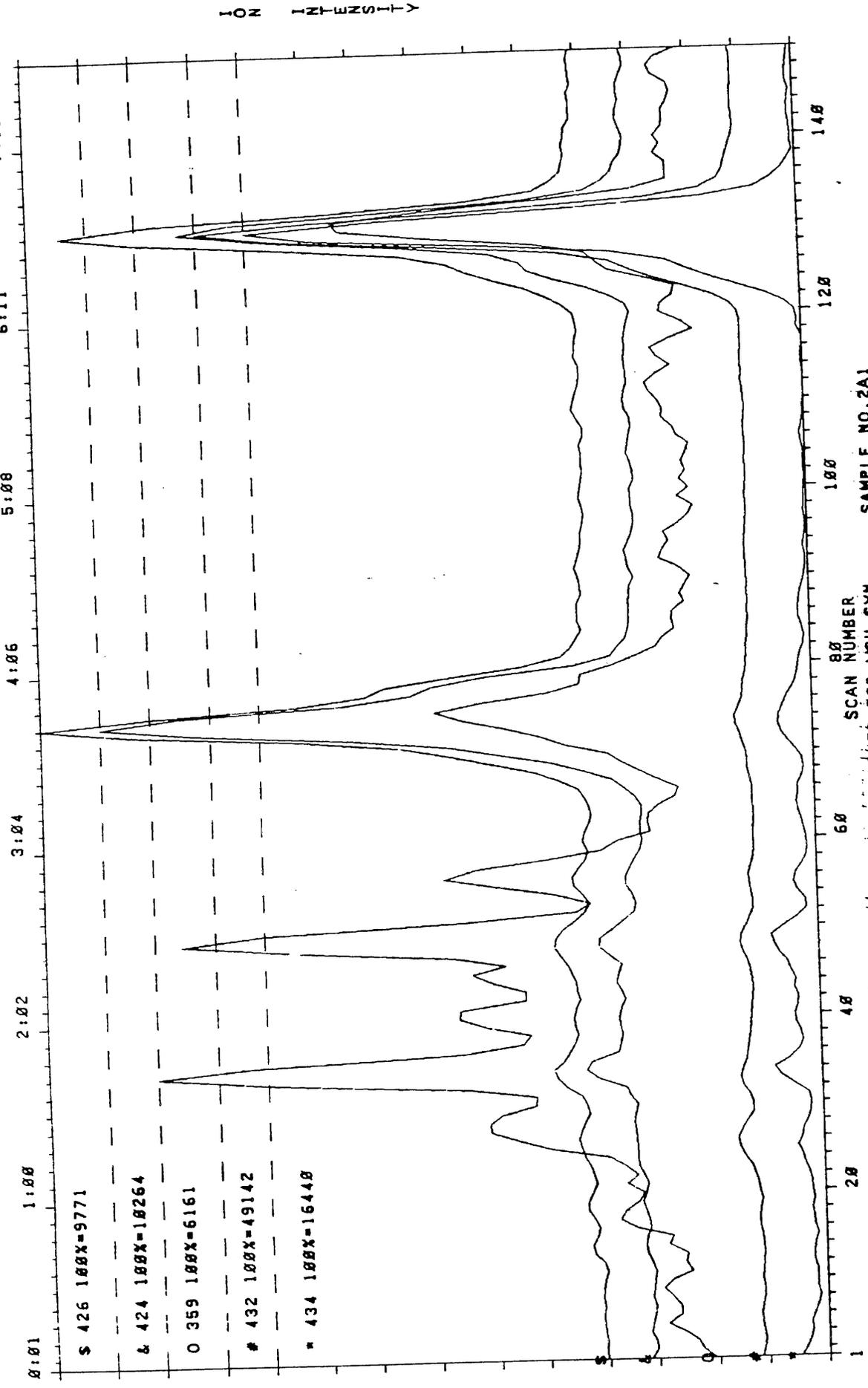
DATE: 02/21/84 TIME: 15:31
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70031, WSU NAME: CHJ-2.10.11.34 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



HRGC-LIMS ANALYSIS OBTAINED FOR WSU SYN
SCAN NUMBER 88 SAMPLE No.2A1
FIGURE: 48

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:31
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70031, WSU NAME: CHJ-2,10,11,34 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



0:01 1:00 2:02 3:04 4:06 5:08 6:11 7:13

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& 424 100X=10264

O 359 100X=6161

432 100X=49142

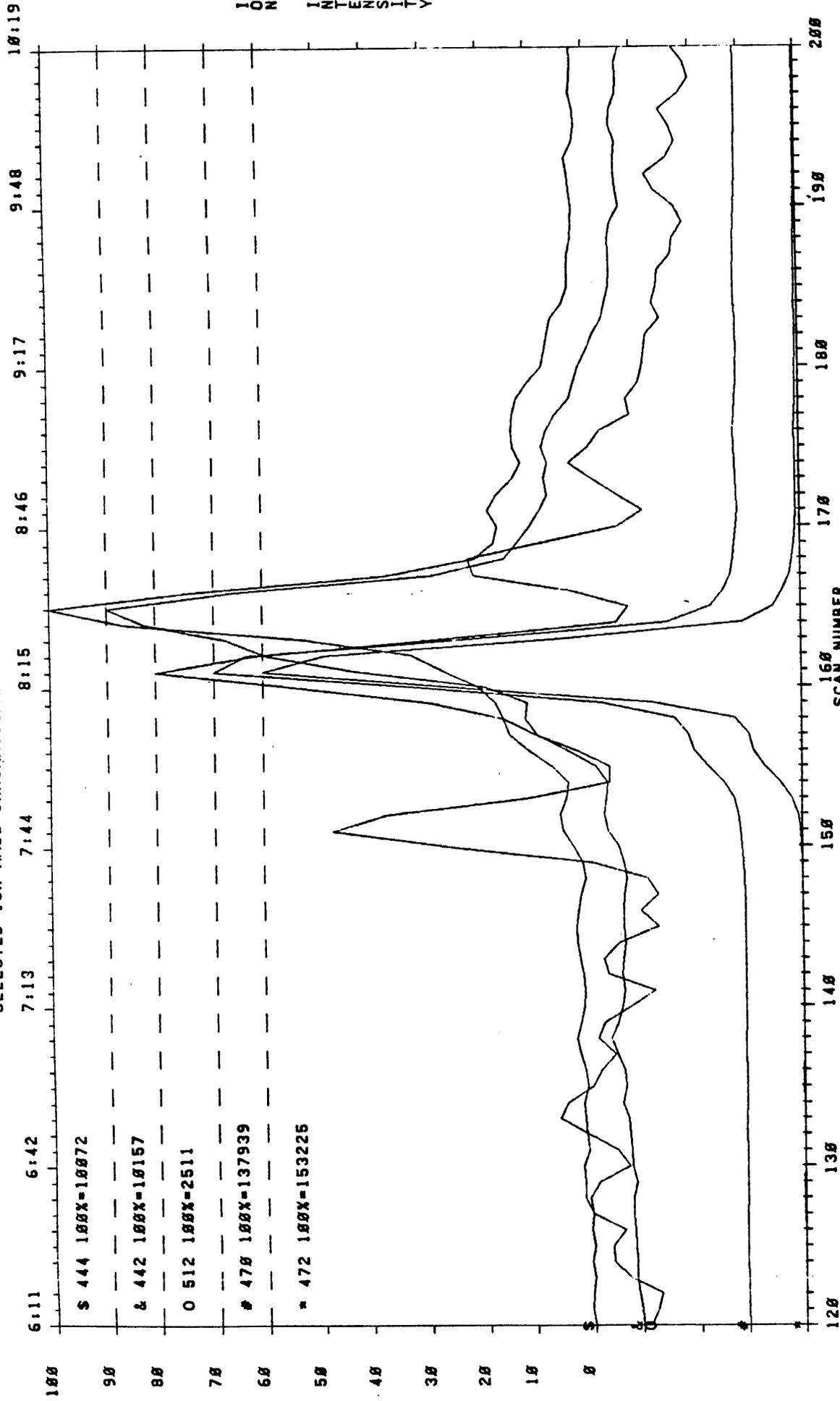
* 434 100X=16448

80 100 120 140
SCAN NUMBER
SAMPLE NO. 2A1
HRGC-LRMS ANALYSIS OBTAINED FOR WSU SYN
FIGURE: 49

BREHM LABORATORY - WRIGHT STAL. UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:42

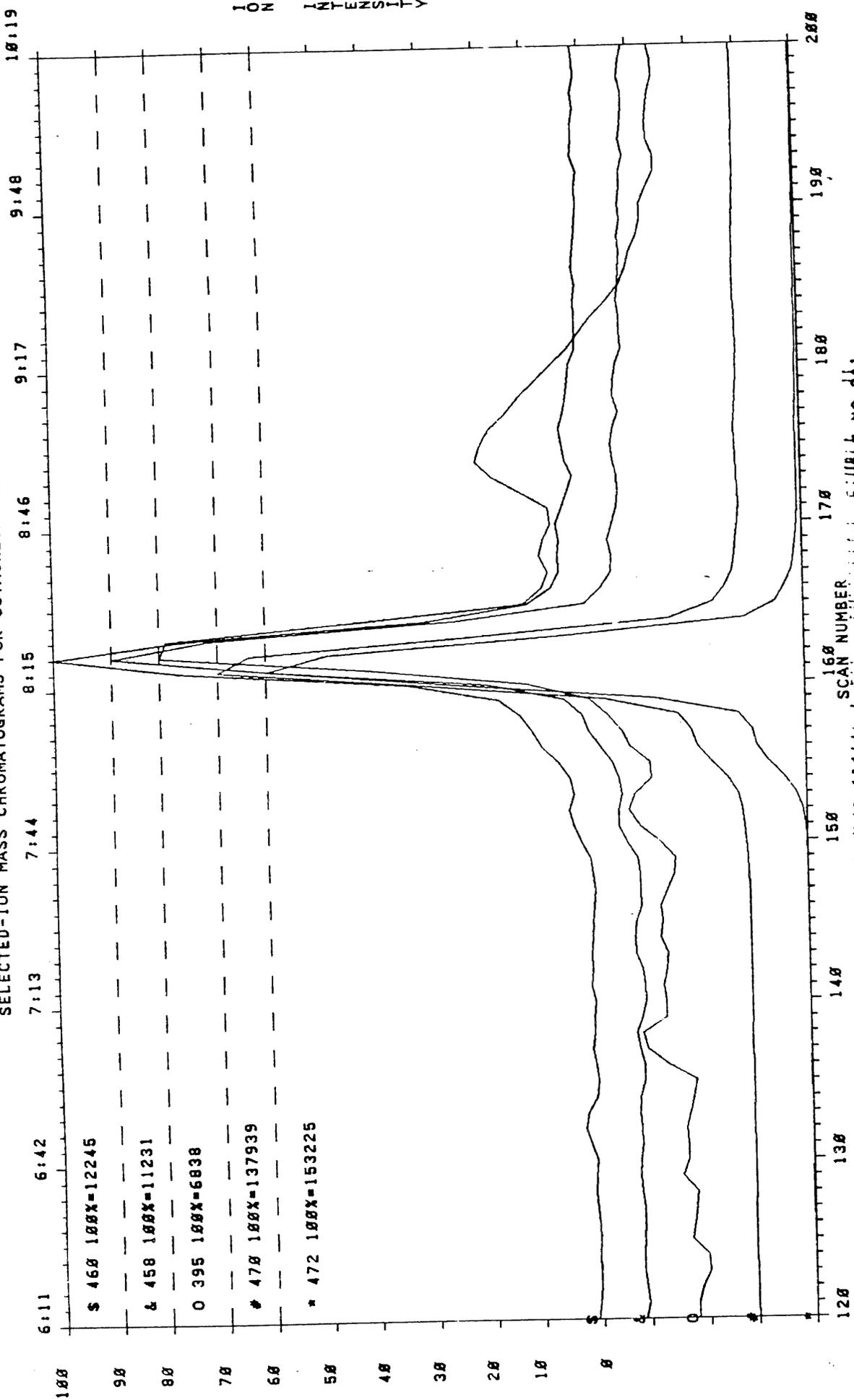
KRATOS MS25, DS55 SOFTWARE, RUN: TOR80038, WSU NAME: CHJ-2.10.11.34 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMOCLOGY SAMPLE NO.2A1
FIGURE: 50

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 15:42
KRATOS MS25, DS55 SOFTWARE, RUN: TOR80038, WSU NAME: CHJ-2,10,11,34, 1, 35
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



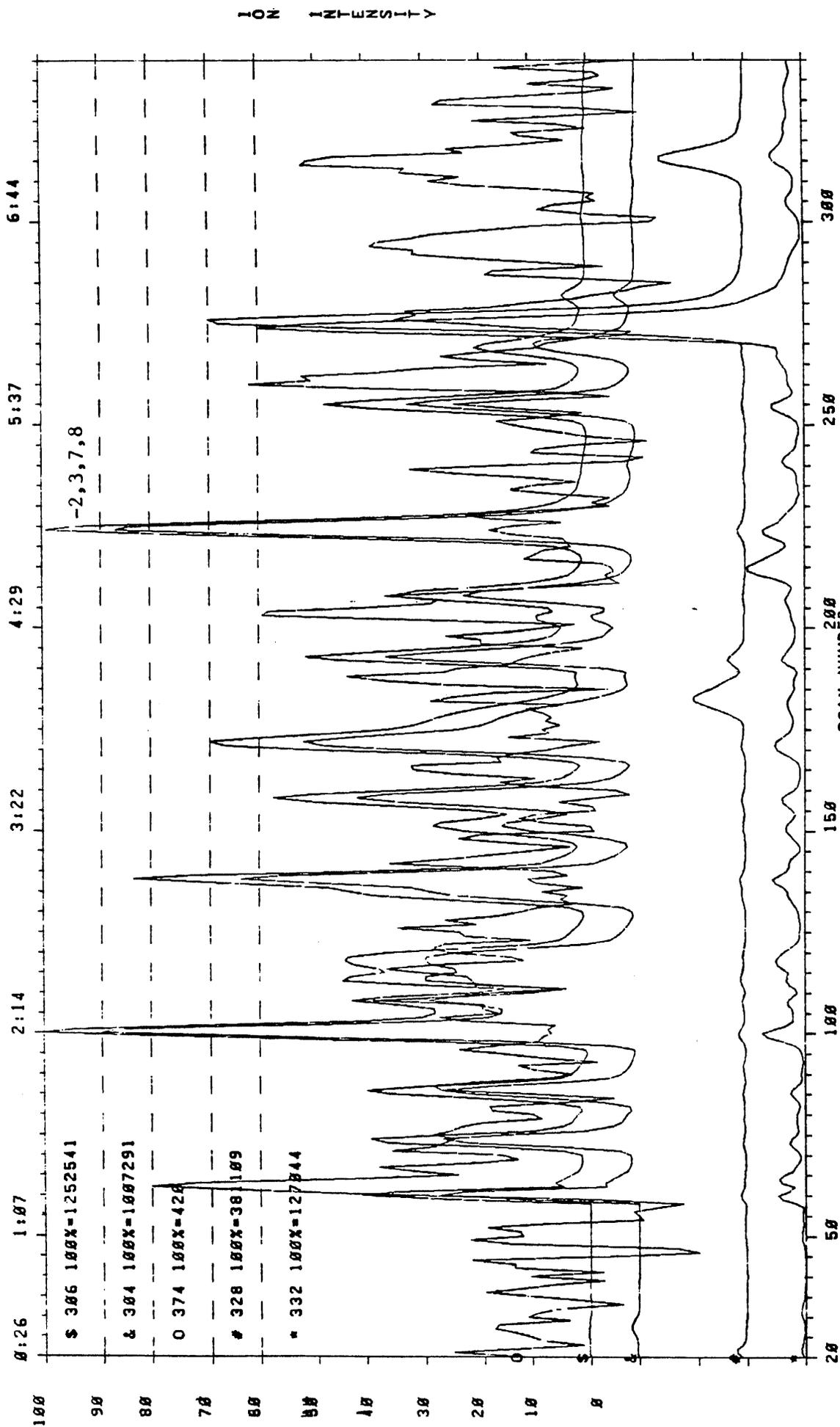
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMOCOLGY SAMPLE NO. 2A1
FIGURE: 51

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

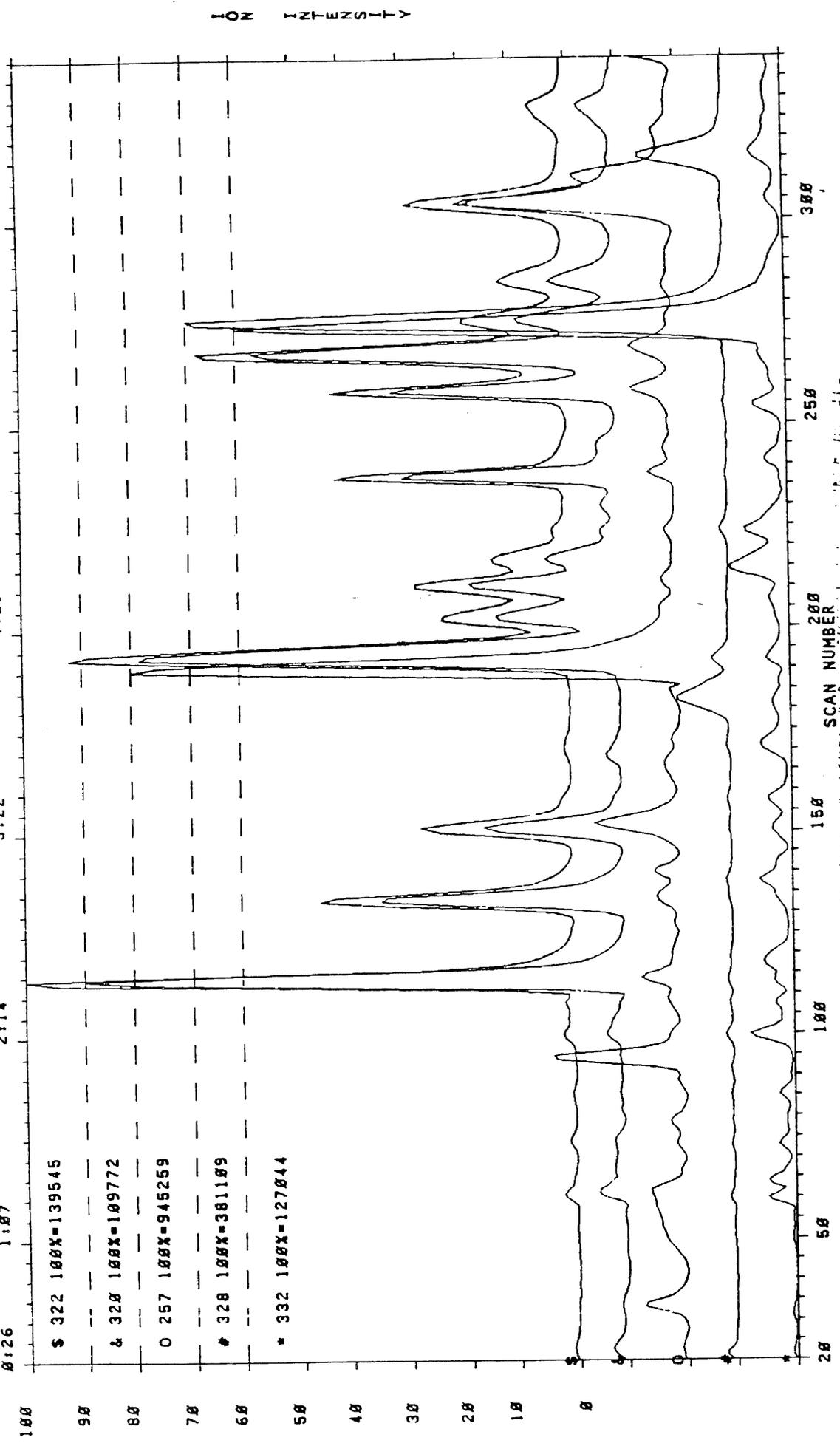
DATE: 02/21/84 TIME: 16:28

KRATOS MS25, DS55 SOFTWARE, RUN: TOR40038, WSU NAME: CHJ-4.12.13.37, 3, 36

SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2
FIGURE: 52

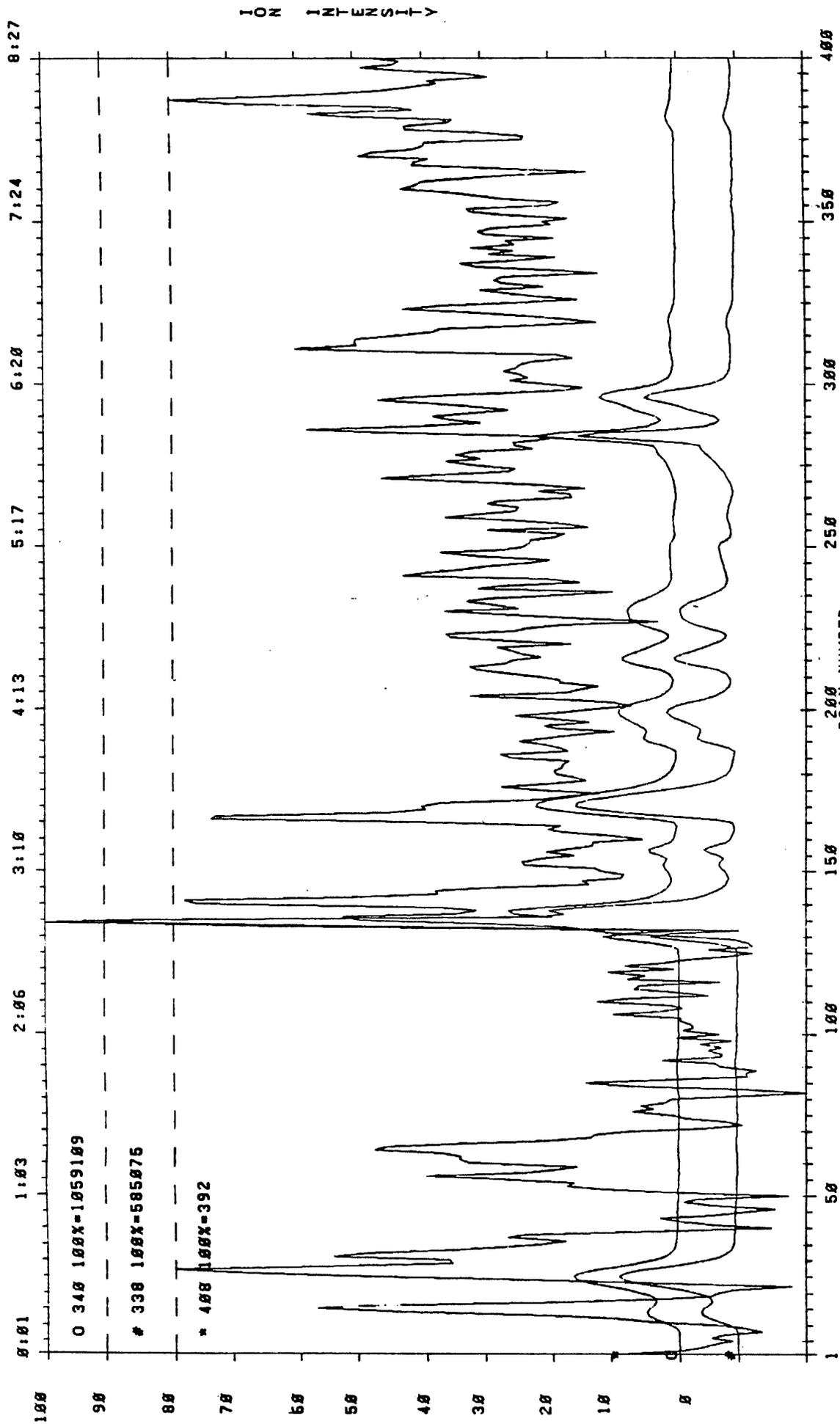


HRGC-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2
FIGURE: 53

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 16:37

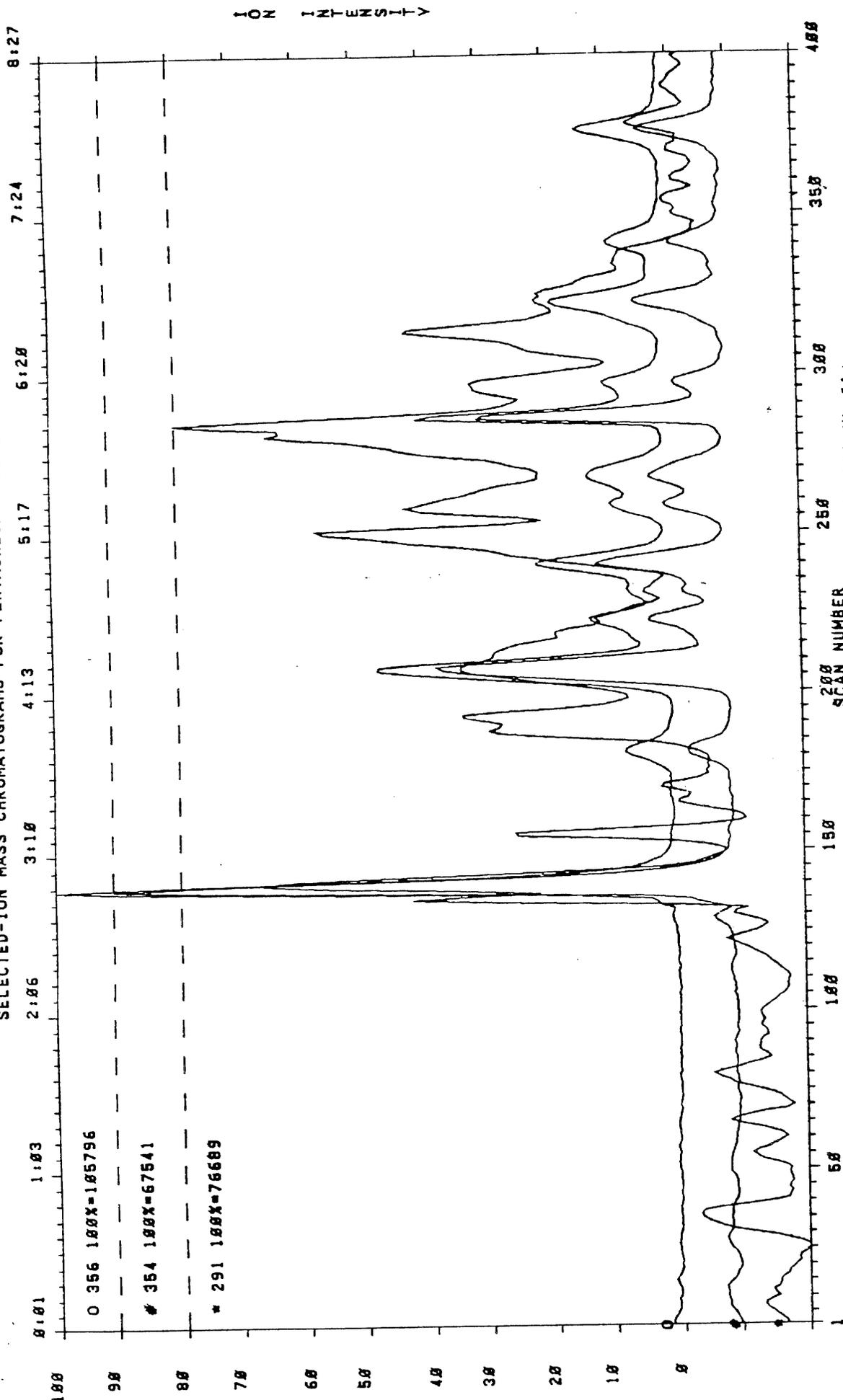
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50031, WSU NAME: CHJ-4.12.13.37, 3, 36
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A2

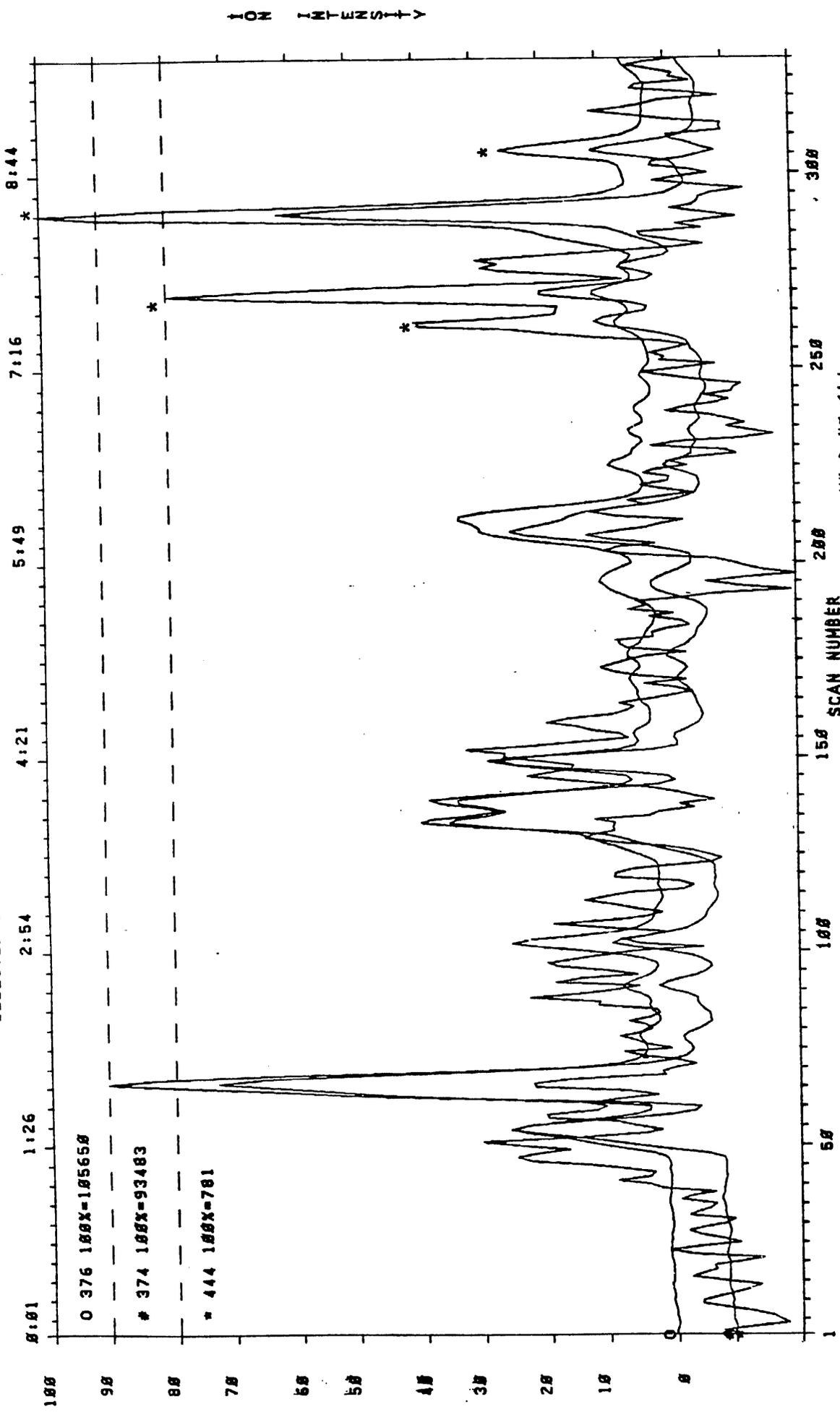
FIGURE: 54

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 02/21/84 TIME: 16:37
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR50031, WSU NAME: CHJ-4,12,13,37, 3, 36
 SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



MASS-LIMS ANALYSIS OBTAINED FOR CHEMOCOLBY SAMPLE NO. 2A2
 SCAN NUMBER 200
 FIGURE: 55

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/21/84 TIME: 16:47
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60033, WSU NAME: CHJ-4.12.13.37, 3, 36
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



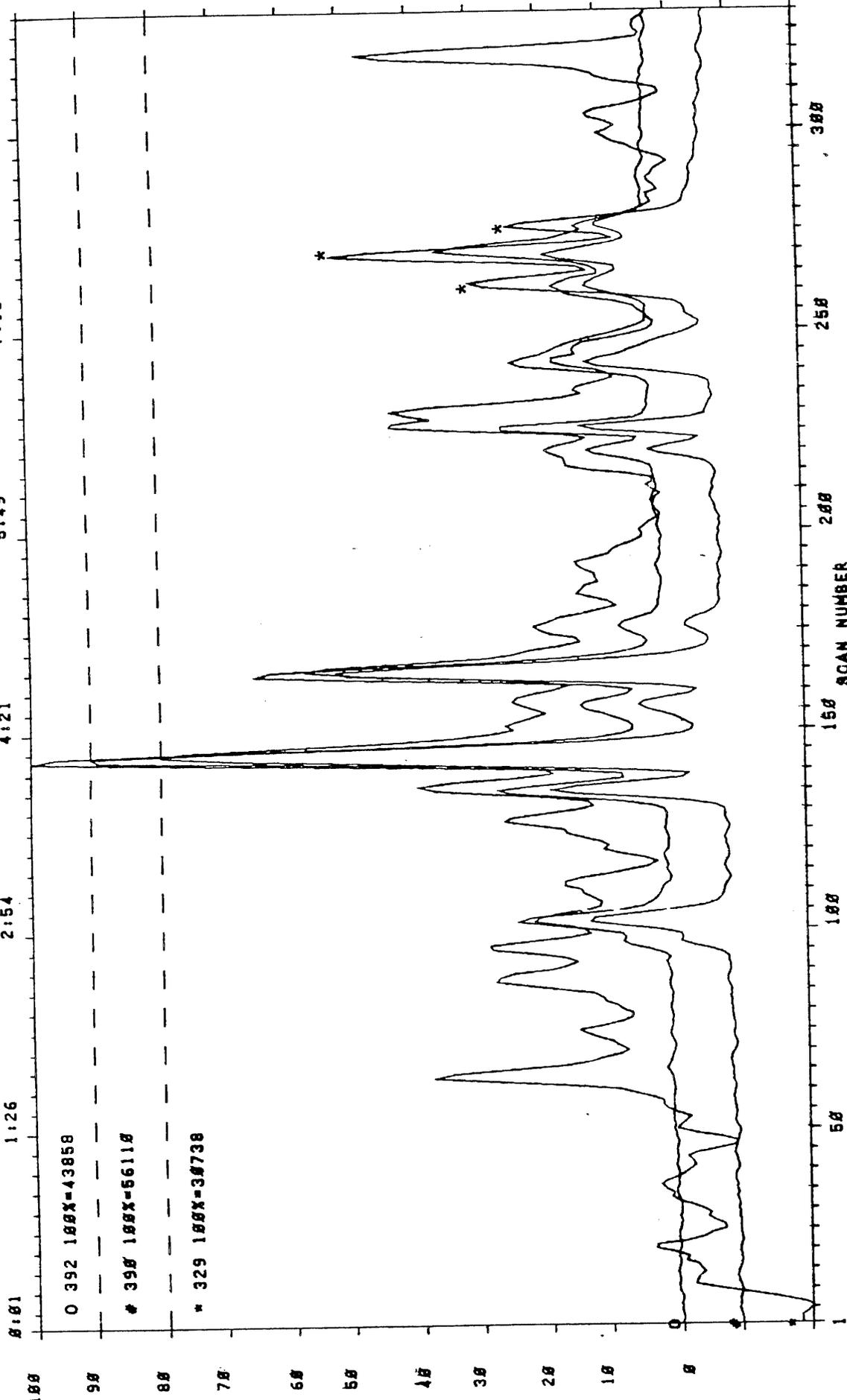
MASS-LIMS ANALYSIS OBTAINED FOR CHEMCOLO66V SAMPLE NO. 2A2
FIGURE: 56

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 16:47

KRATOS MS25, DS55 SOFTWARE, RUN: TOR60033, WSU NAME: CHJ-4,12,13,37, 3, 36
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS

8:01 1:26 2:54 4:21 5:49 7:16 8:44



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* 398 100X=56118

* 329 100X=38738

300

250

200

150

100

50

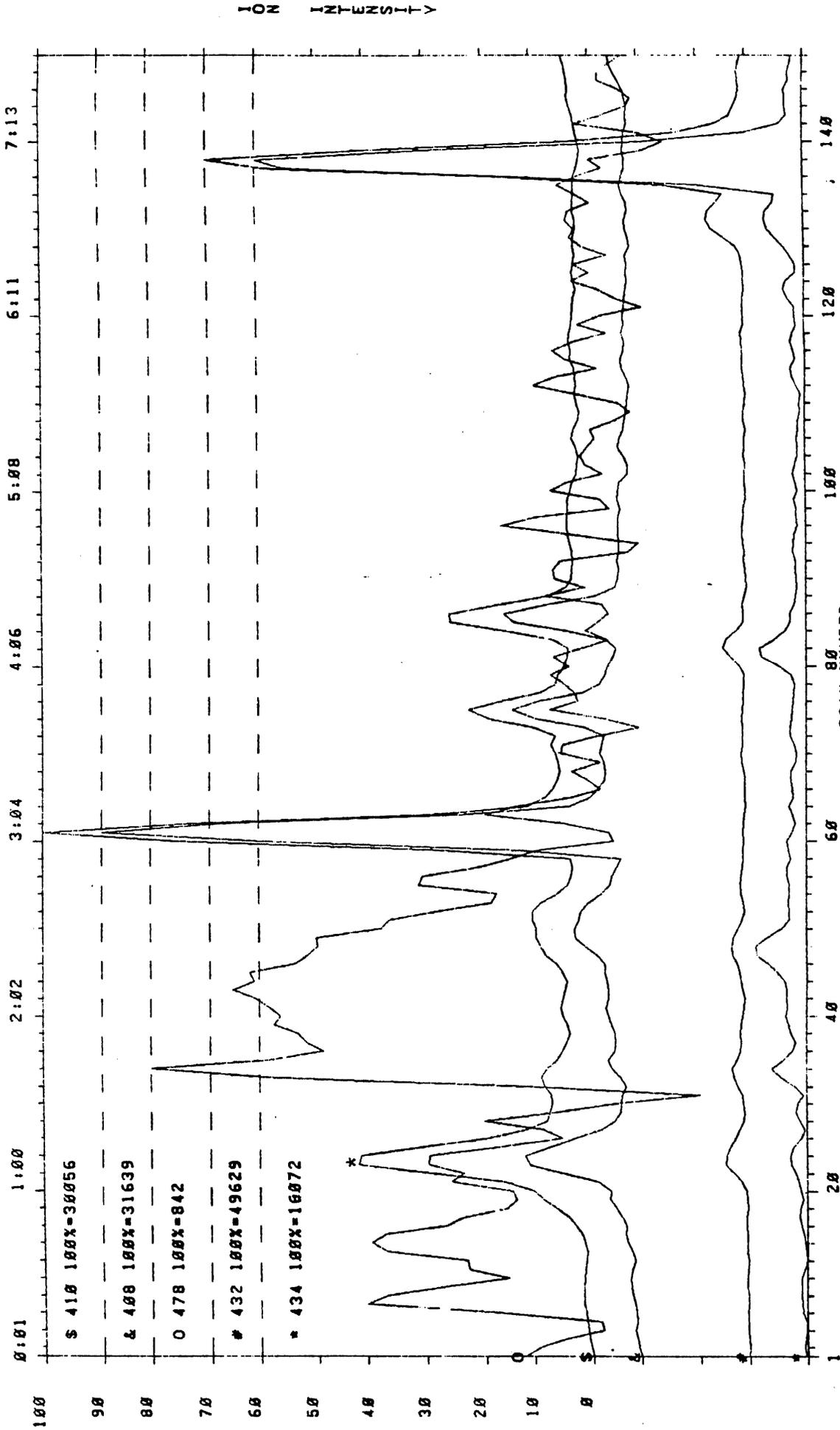
SCAN NUMBER

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2

FIGURE: 57

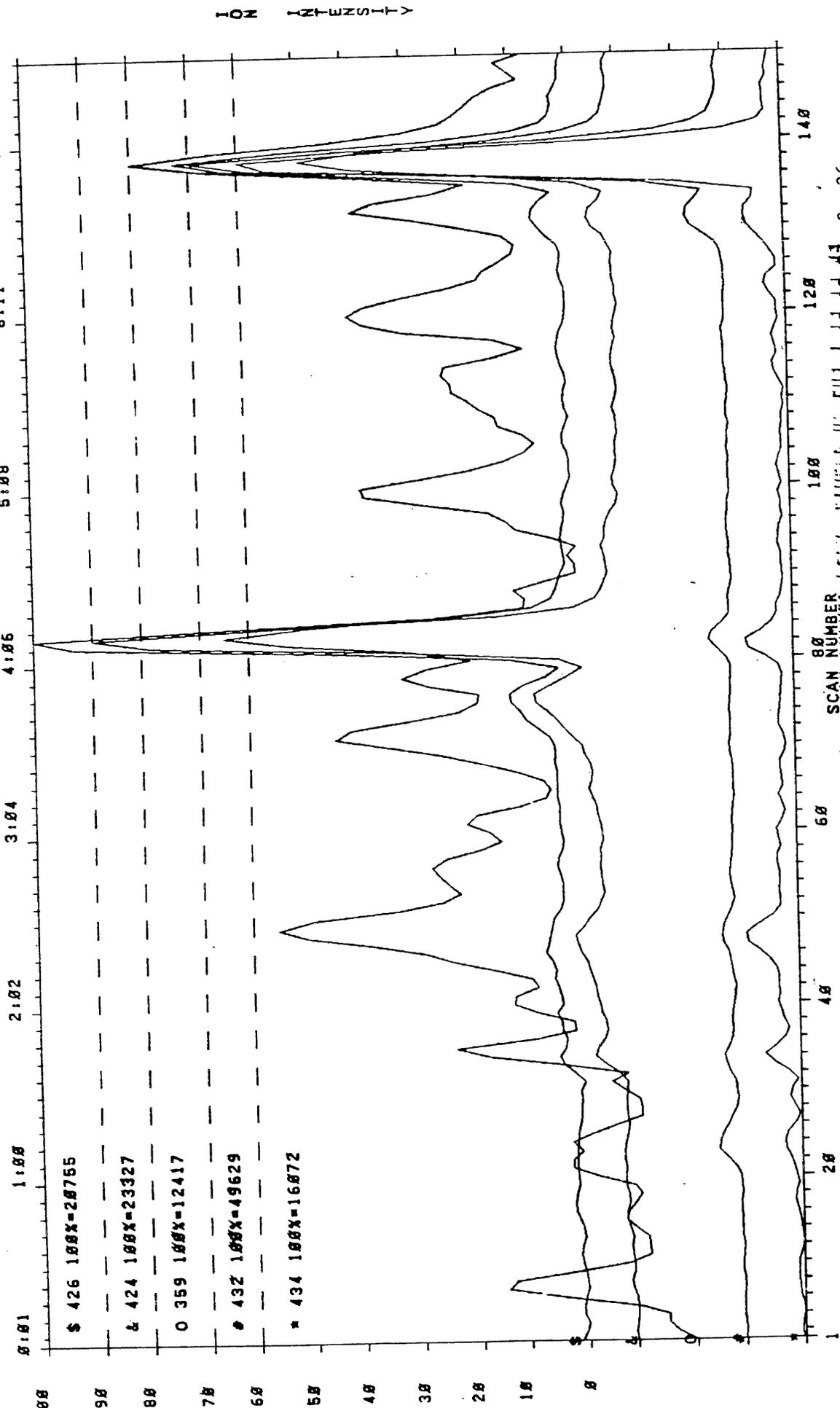
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21/84 TIME: 16:57
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70032, WSU NAME: CHJ-4.12.13.37 3, 36
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A2
FIGURE: 58

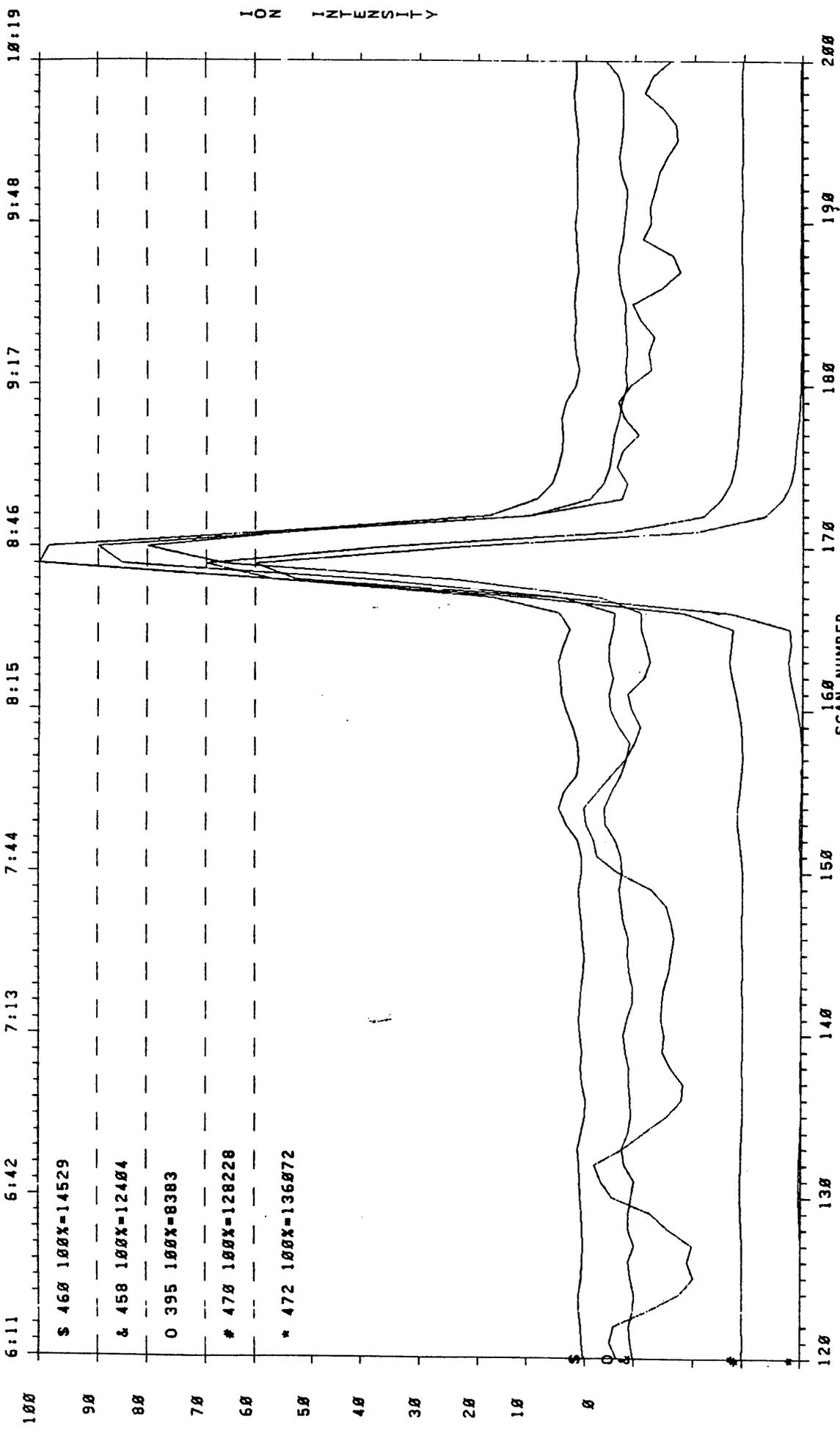
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45436
 DATE: 02/21/84 TIME: 16:57
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR70932, WSU NAME: 2A2
 SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



HRGC-LCMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. CHJ-4, 12, 13, 17, 3, 36
 SCAN NUMBER
 FIGURE: 59

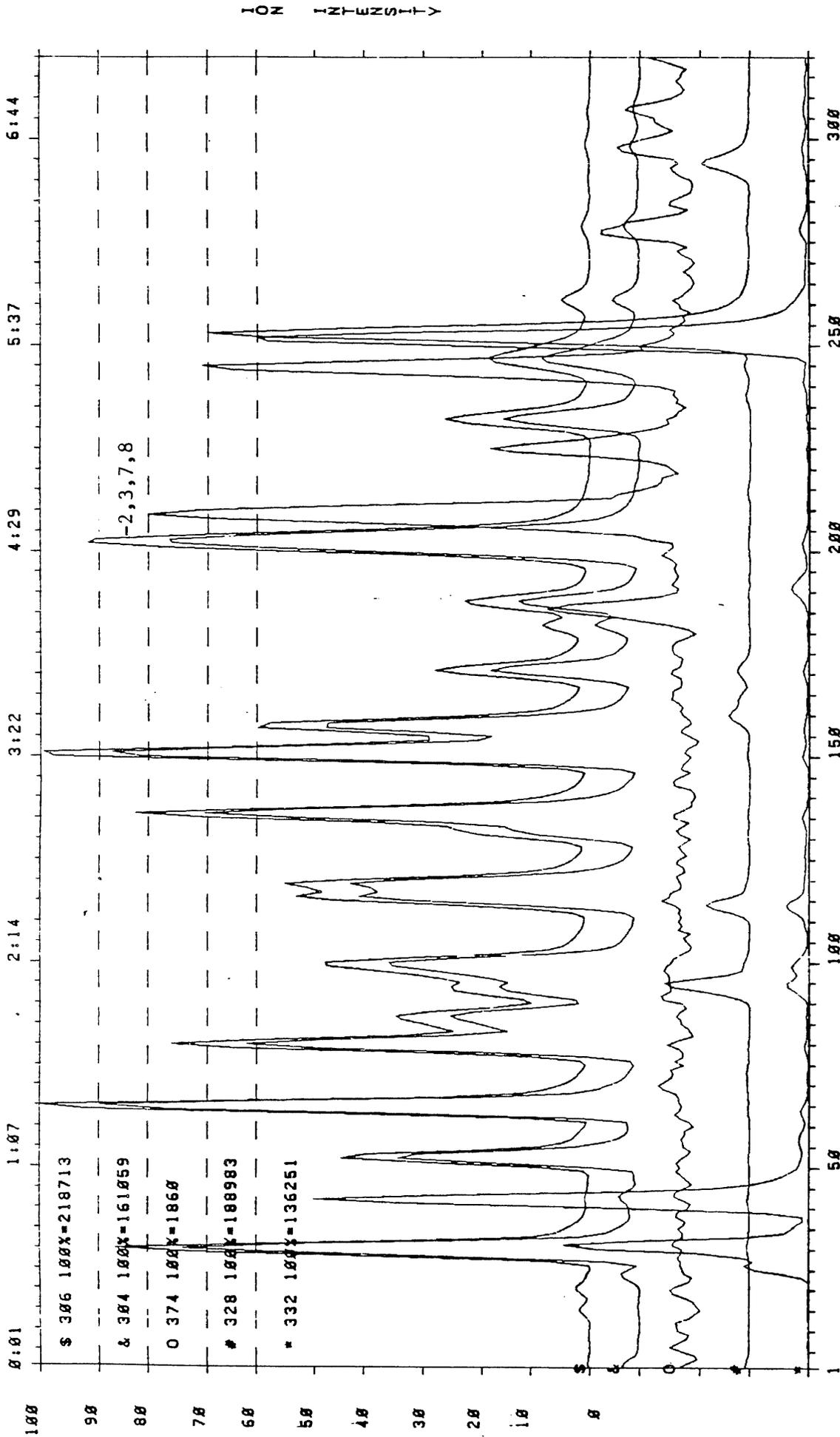
BKEHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/21 4 TIME: 17:20
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SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A2
FIGURE: 61

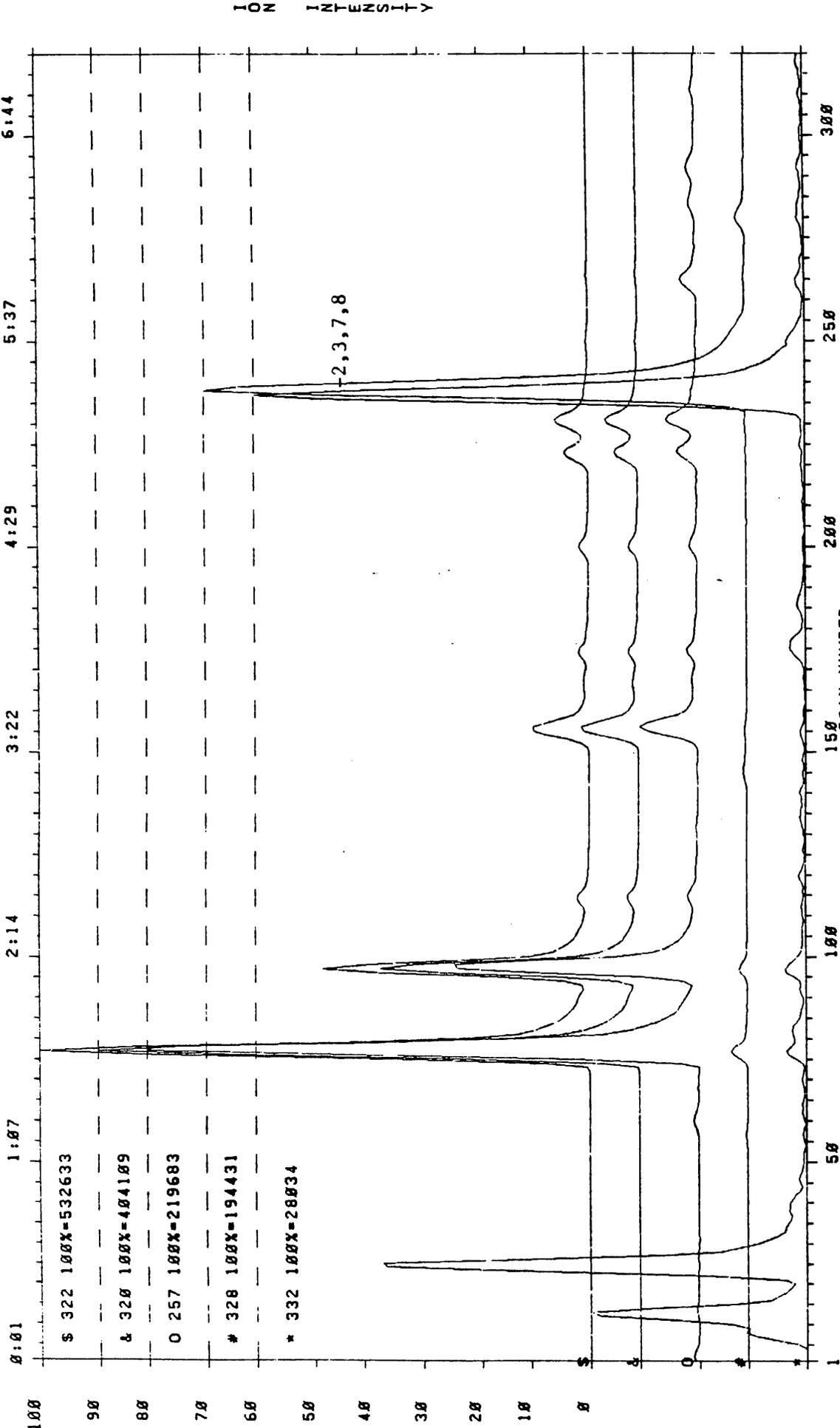
DATE: 02/23/84 TIME: 13:21
KRTG5 MS25, DS55 SOFTWARE, RUN: TOR40049, WSU NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.251
FIGURE: 134

BREHM LABORATORY · WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 17:39
KRATOS MS25, DS55 SOFTWARE, RUN: TOR40052, WSU NAME: CHJ-19.20.28, 47
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



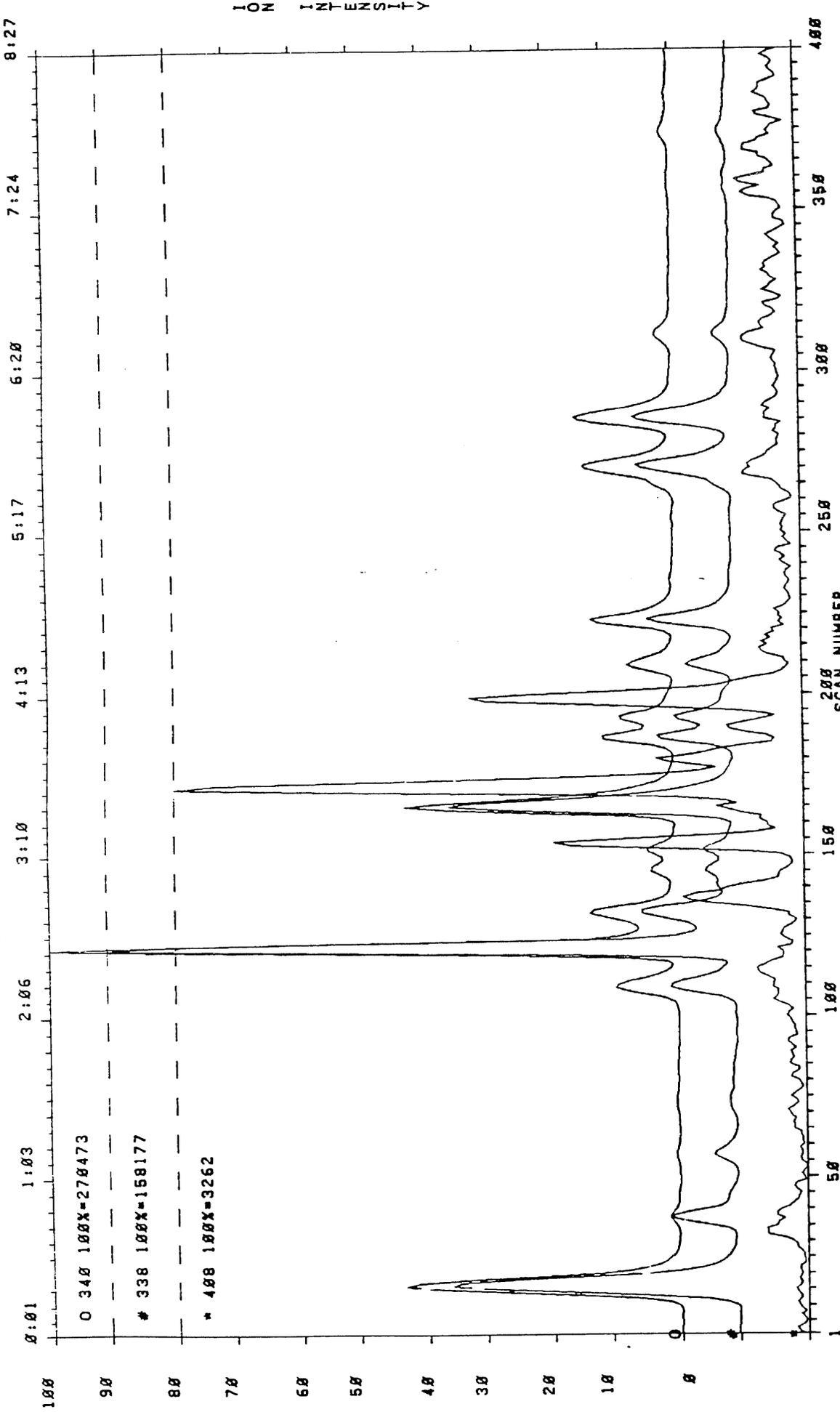
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D1
FIGURE: 135

BREHME LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 13:30

KRATON MS25, DISE SOFTWARE, RUN: TOR50040, WSU NAME: CHJ-19,20,28,47

SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



0:01 1:03 2:06 3:10 4:13 5:17 6:20 7:24 8:27

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338 100X=158177

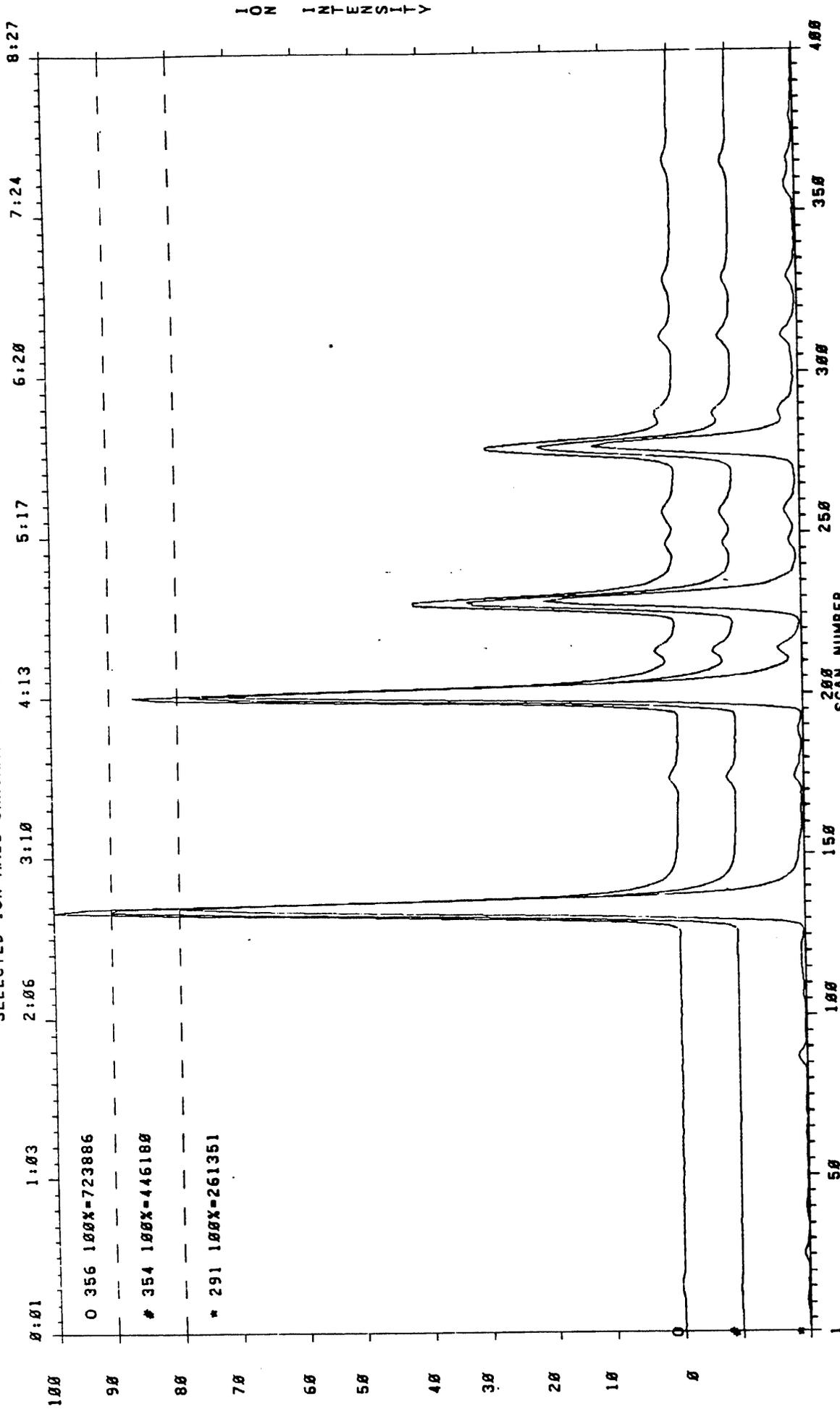
* 408 100X=3262

MASS-ION ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.201
FIGURE: 136

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/8 TIME: 13:30

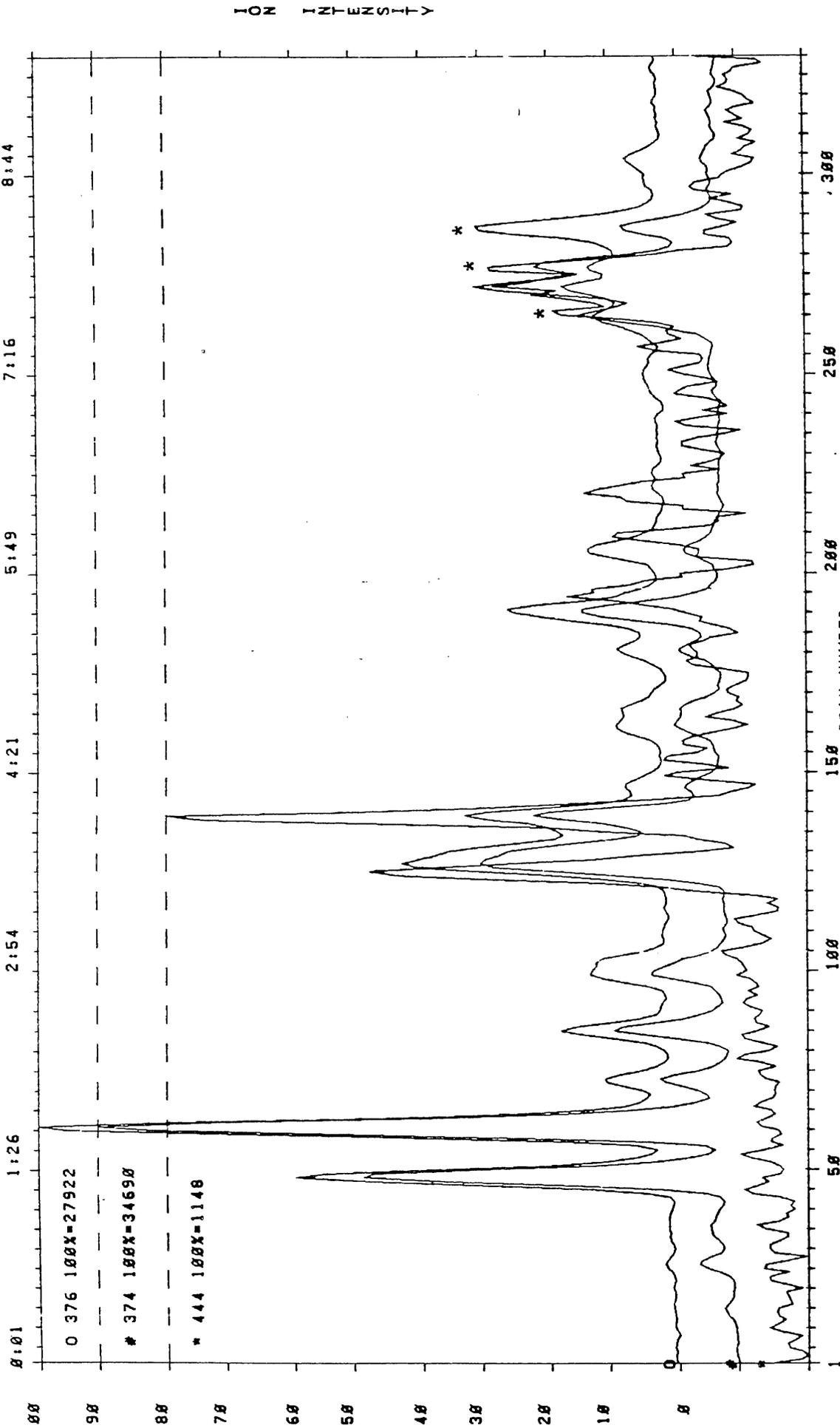
KRATOS MS25, DS55 SOFTWARE, RUN: 10R50040, WSU NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



HRGC-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2b1
FIGURE: 137

BREIT LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 13:41
KRATOS MS25, DS5E SOFTWARE, RUN: TOR60041, WSU NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



0:01 1:26 2:54 4:21 5:49 7:16 8:44

0 376 100X=27922
374 100X=34690
* 444 100X=1148

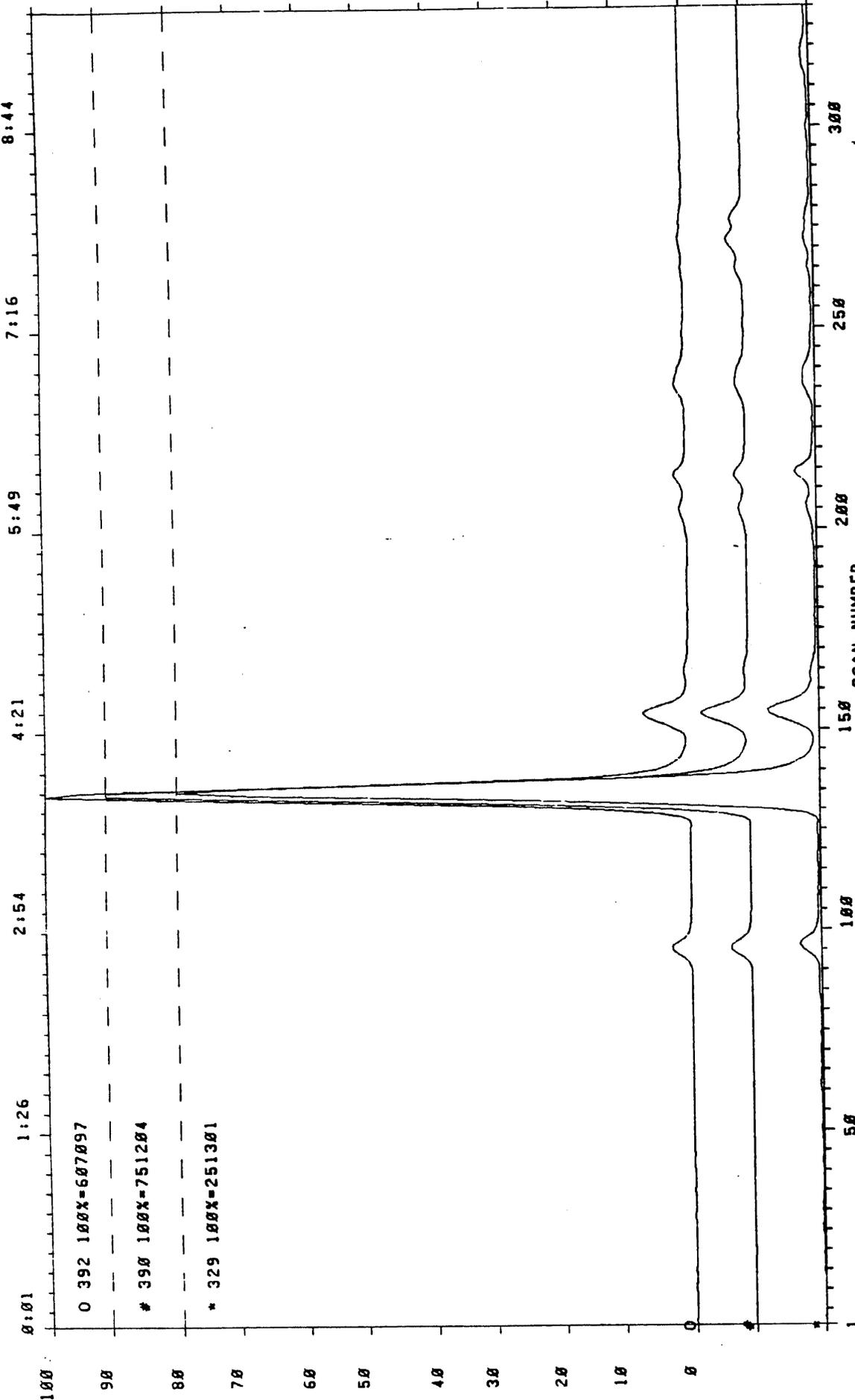
50 100 150 200 250 300

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D1
FIGURE: 138

ION INTENSITY

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/80 TIME: 13:41
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60041, WSU NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS



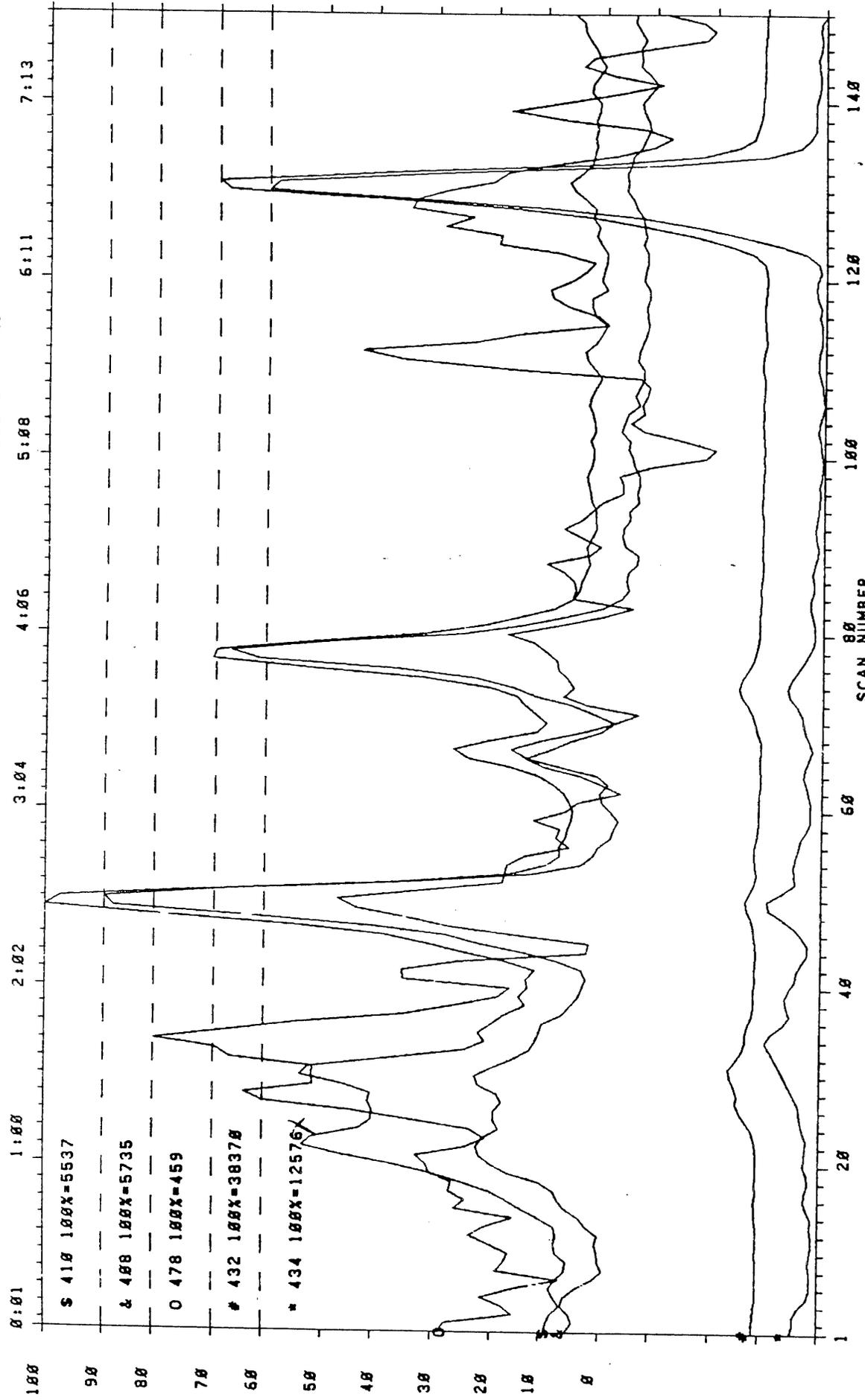
MRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2b1
FIGURE: 139

REIN LABORATORY WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 13:49

KRATOS MS25, DS55 SOFTWARE, RUN: TOR70040, WSU NAME: CHJ-19,20,28, 47
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS

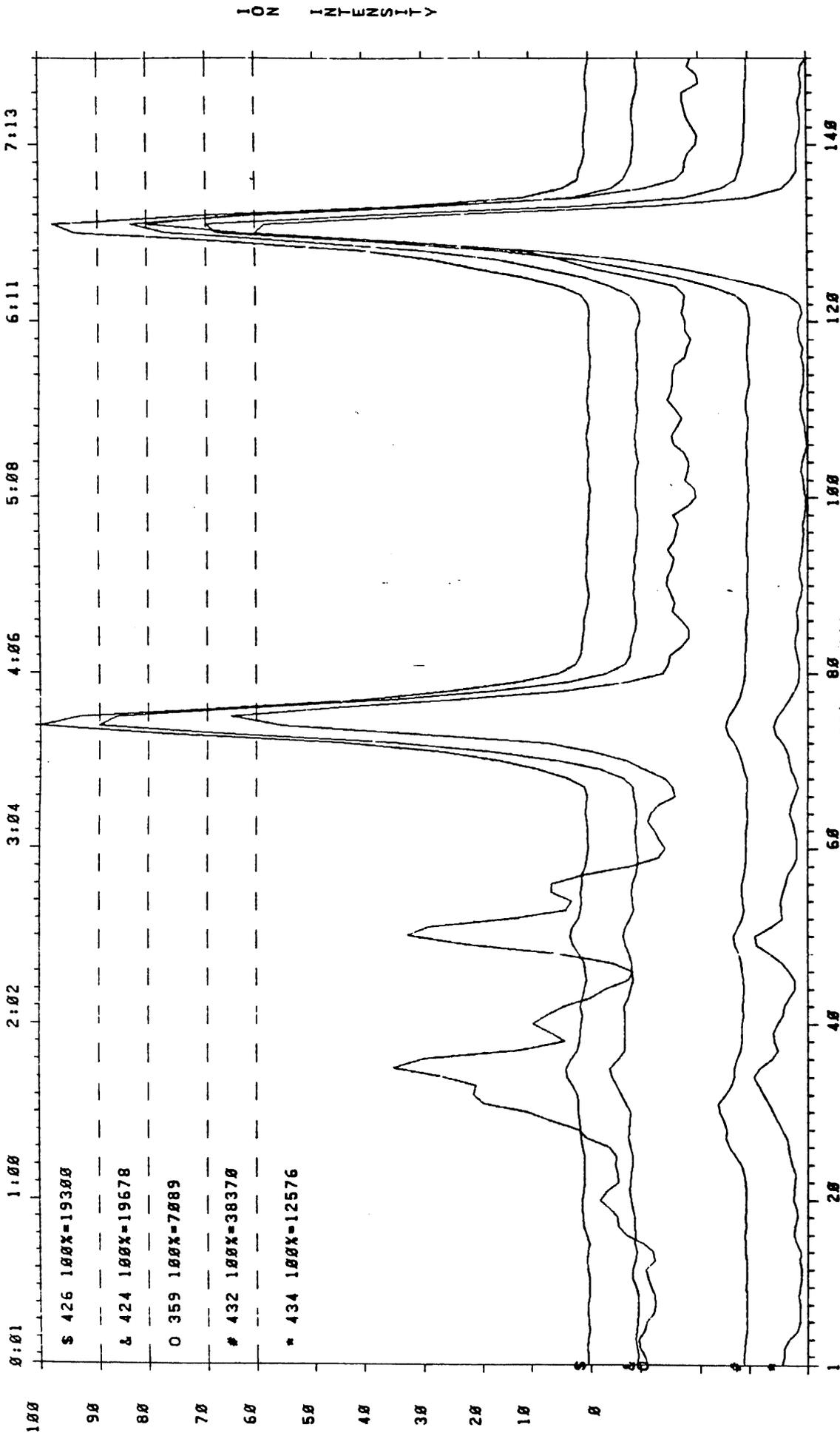
ION INTENSITY



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE No. 2b1
SCAN NUMBER 80 100 120 140
FIGURE: 140

DATE: 02/23/80 TIME: 13:49

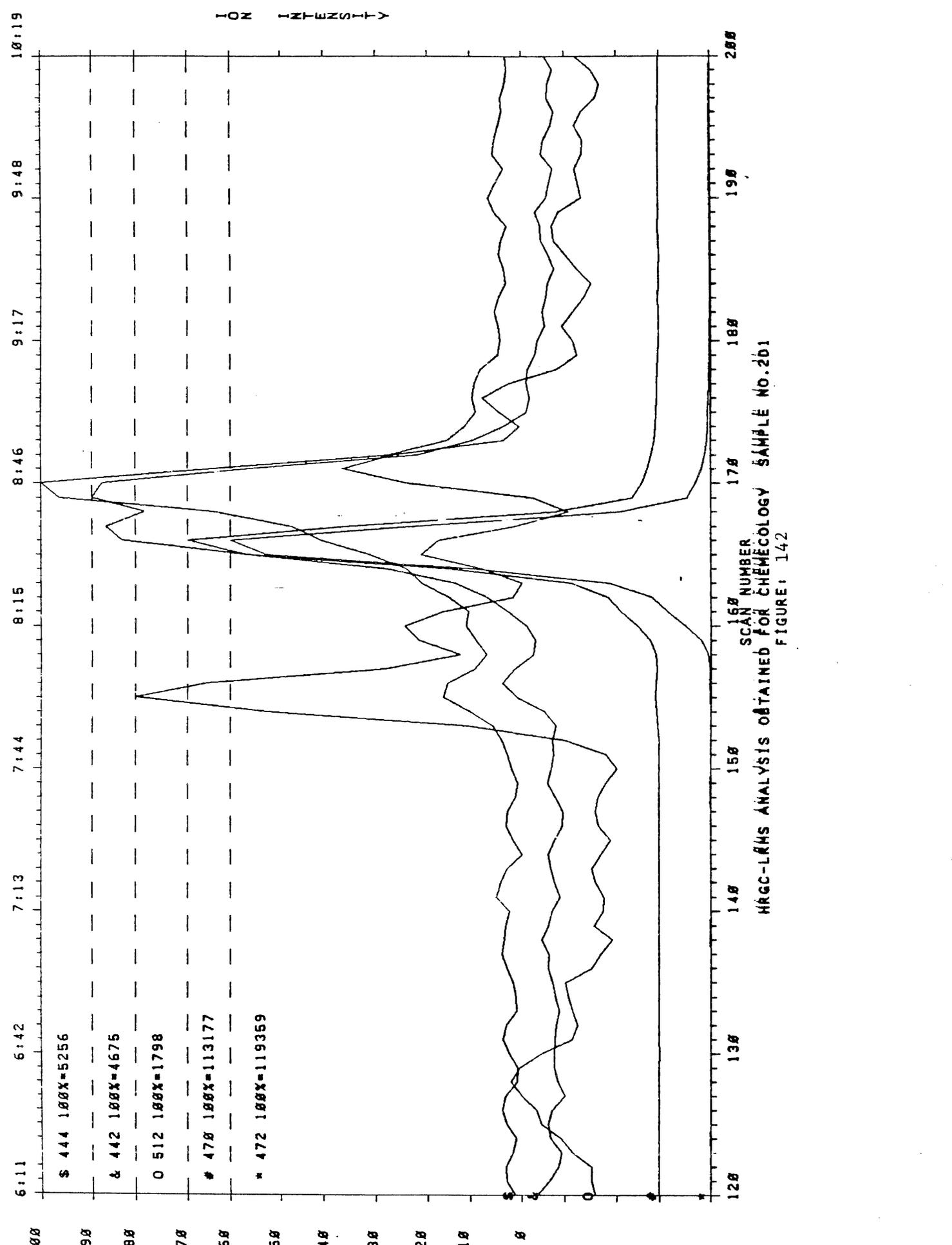
KRATOS MS25, DS55 SOFTWARE, RUN: JR70040, WSU NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



HGGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2b1
FIGURE: 141

DATE: 02/23/84 TIME: 14:06

KRATO. MS25, DS55 SOFTWARE, RUN: TOR80047, WSJ NAME: CHJ-19,20,28,47
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS

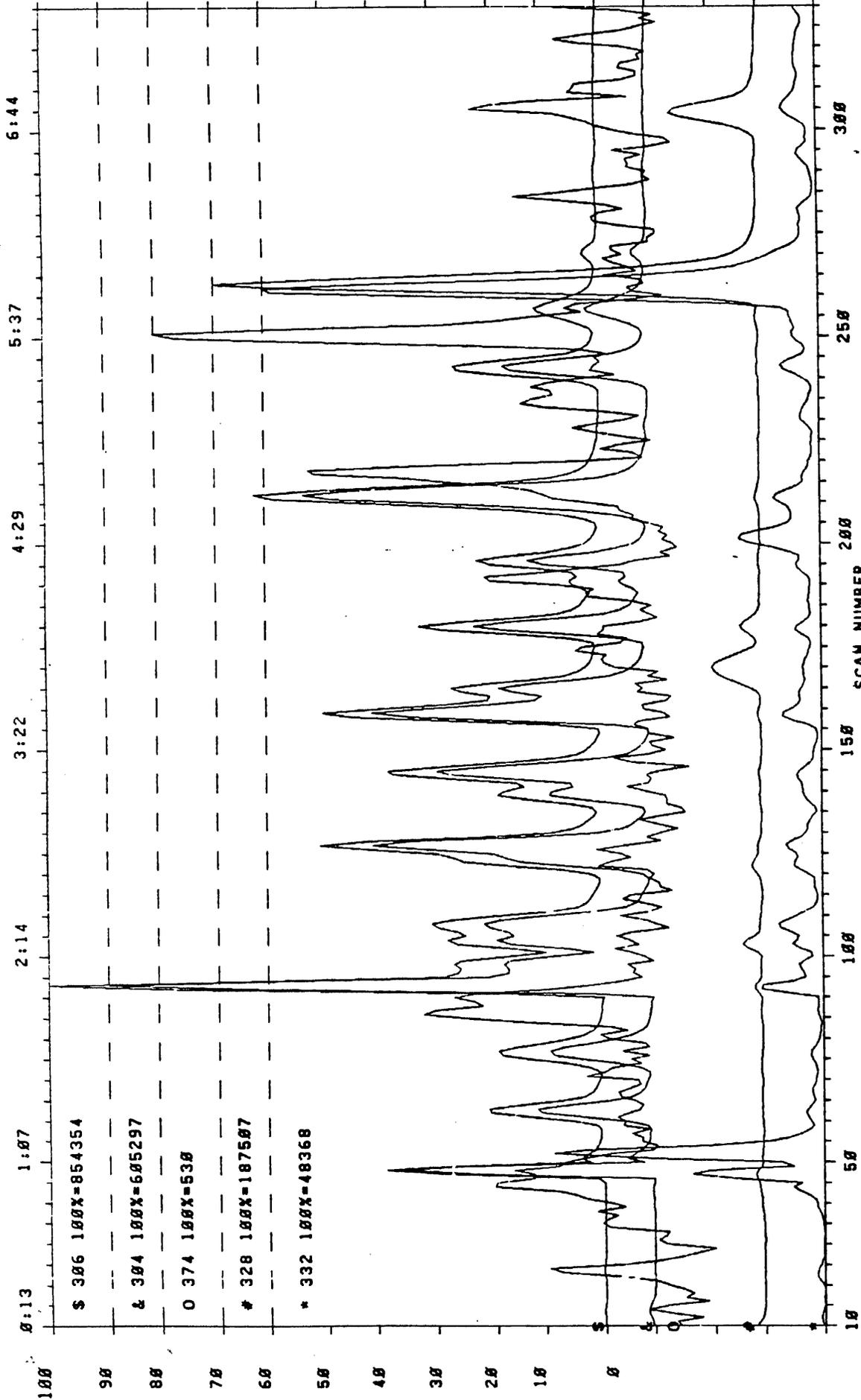


HGCC-LRHS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 201
FIGURE: 142

ION INTENSITY

BREHME LABORATORY - OHIO STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/ TIME: 14:57
KRATOS MS25, DS95 SOFTWARE, RUN: TOR40050, WSU NAME: CHJ-21.30.49
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS

*Impurity
7/1/1988*

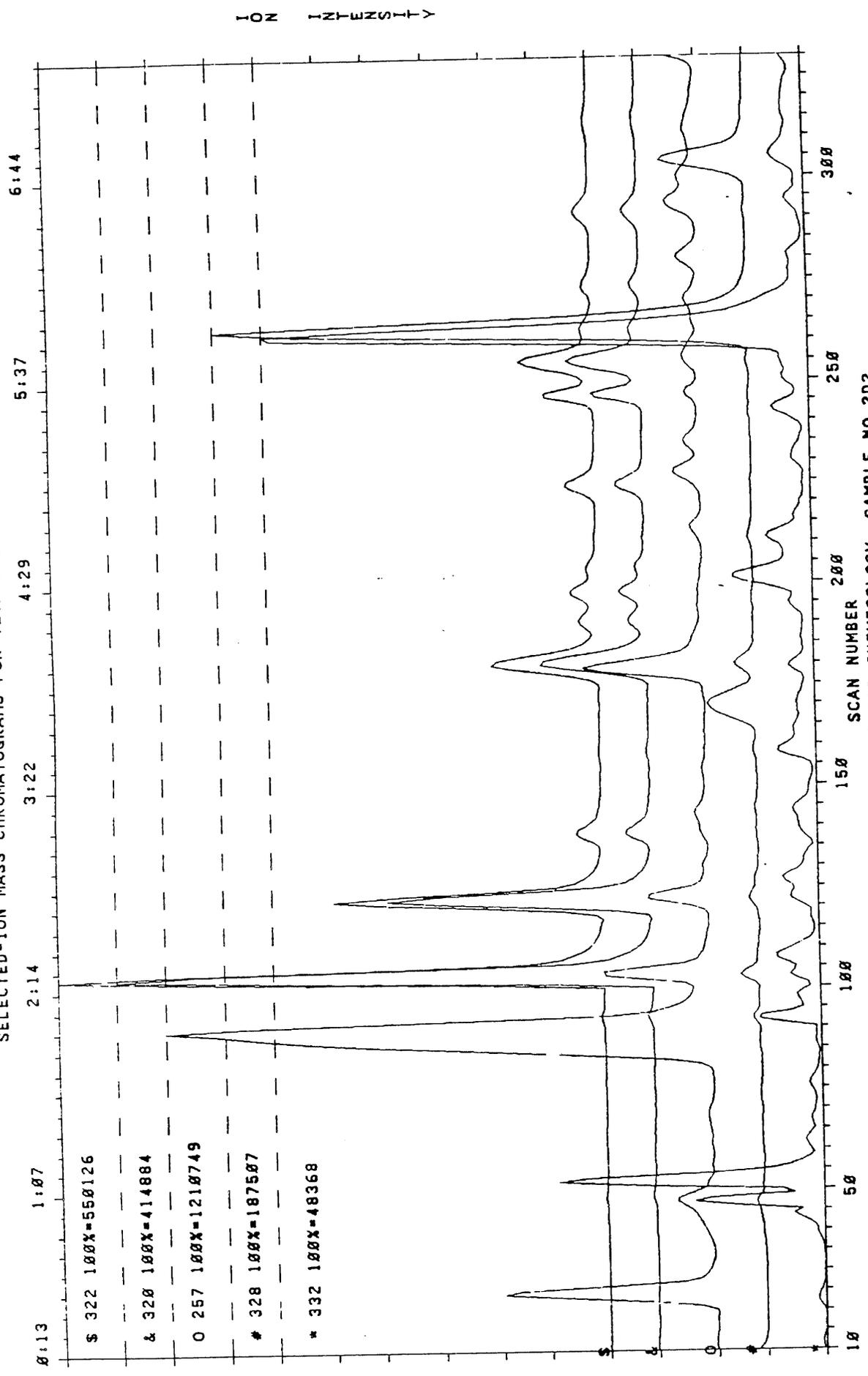


0:13 1:07 2:14 3:22 4:29 5:37 6:44

\$ 306 100X=854354
& 304 100X=605297
O 374 100X=538
328 100X=187587
* 332 100X=48368

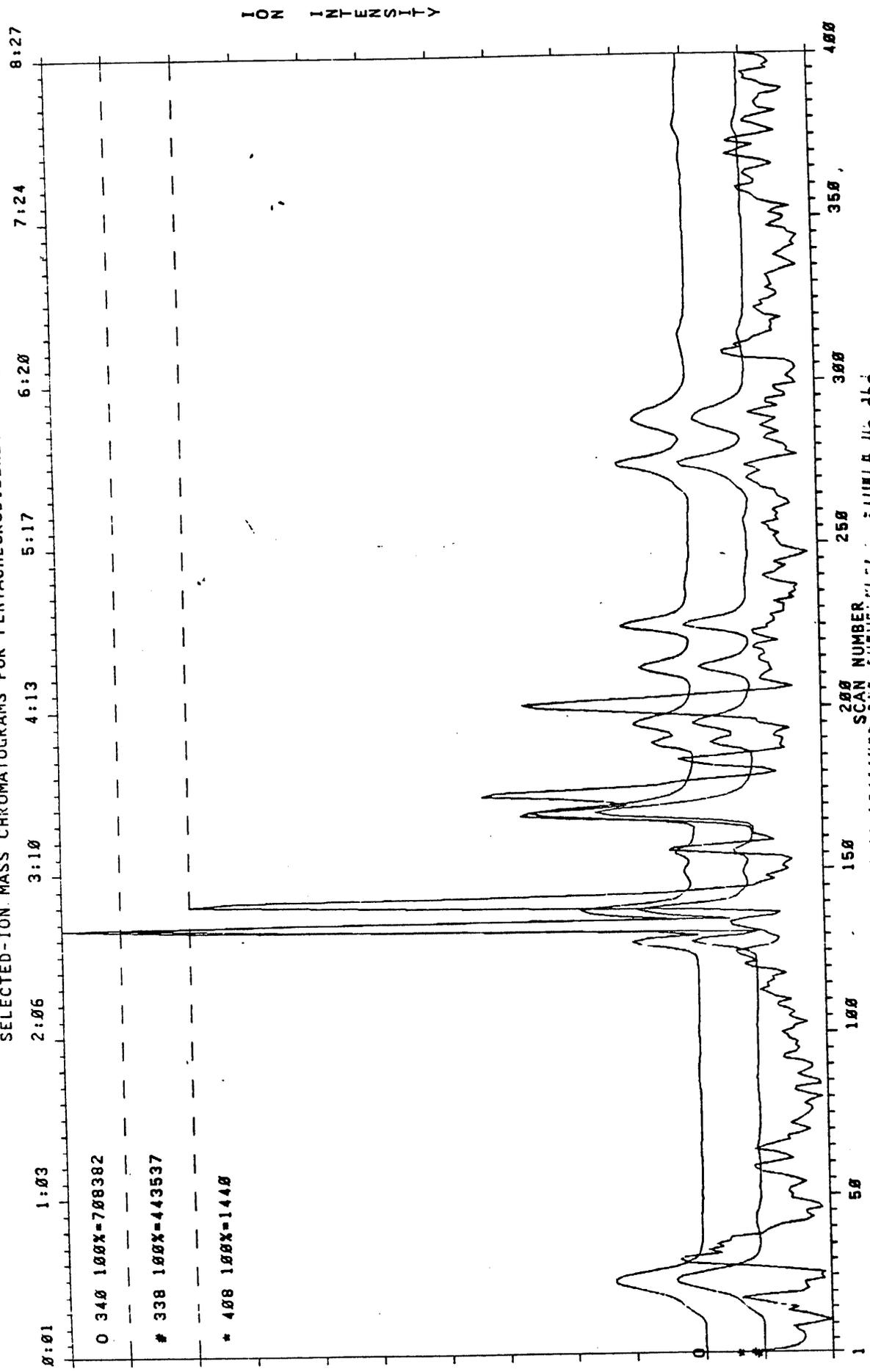
MASS-SCAN ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202
FIGURE: 144

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 02/23/84 TIME: 14:57
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR40050, WSU NAME: CHJ-21.30.49
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.202
 FIGURE: 145

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/84 TIME: 15:06
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50041, WSU NAME: CHJ-21,30,49
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS

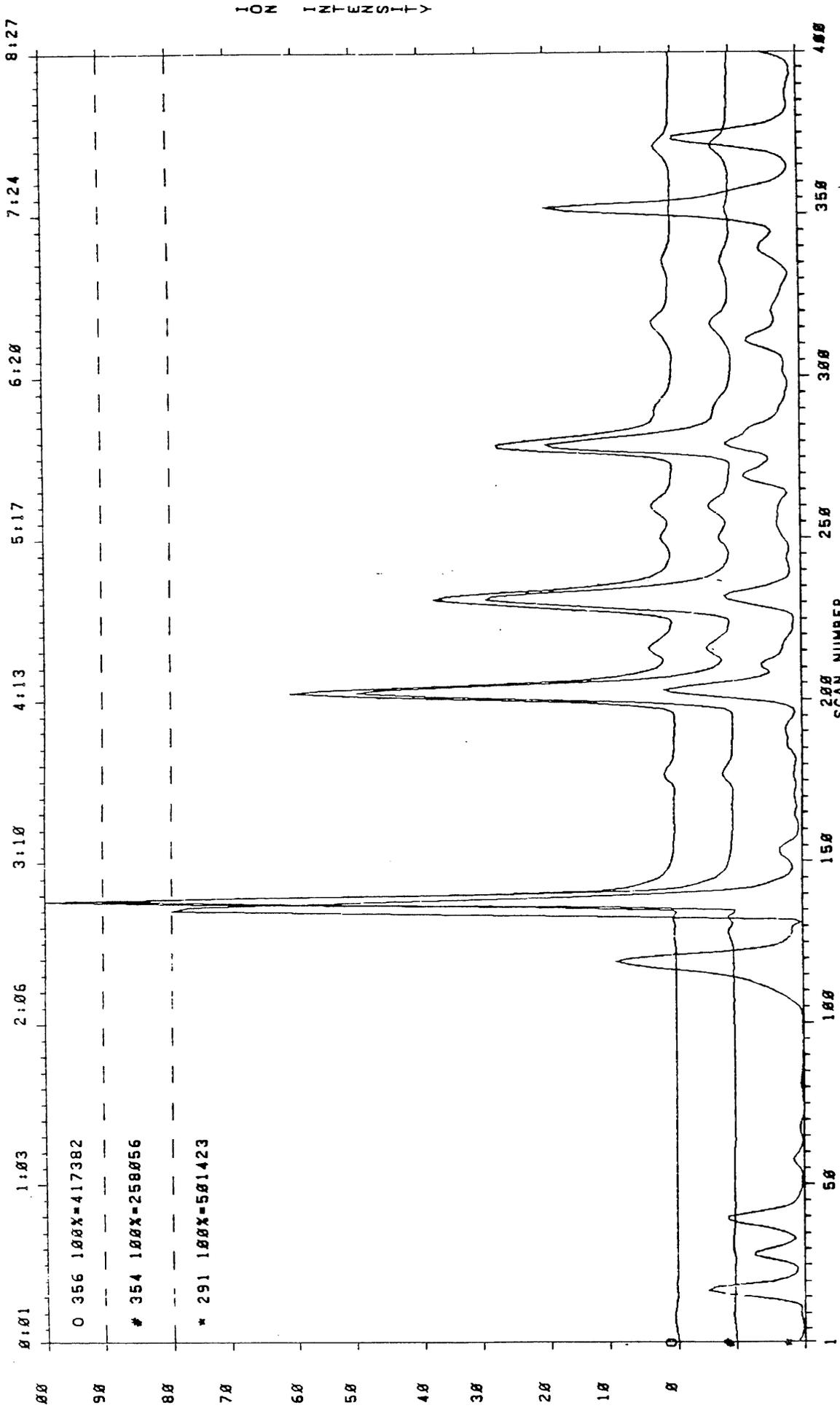


MASS-LEADS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE No.2b2
FIGURE: 146

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO. 45435

DATE: 02/23/84 TIME: 15:06

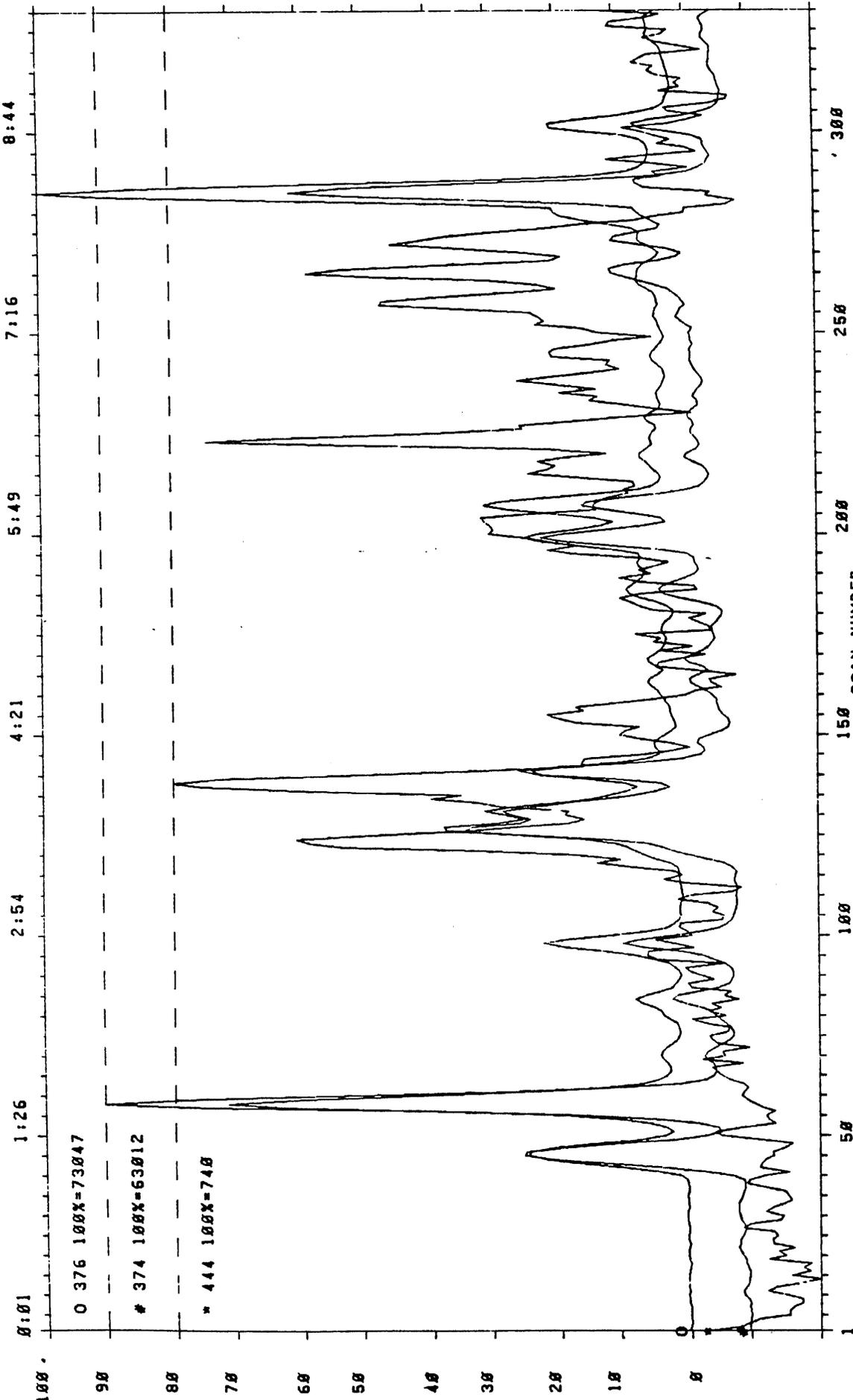
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50041, WSU NAME: CHJ-21,30,49
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 202
FIGURE: 147

ION INTENSITY

KREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/84 TIME: 15:16
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60042, WSU NAME: CHJ-21,30,49
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS

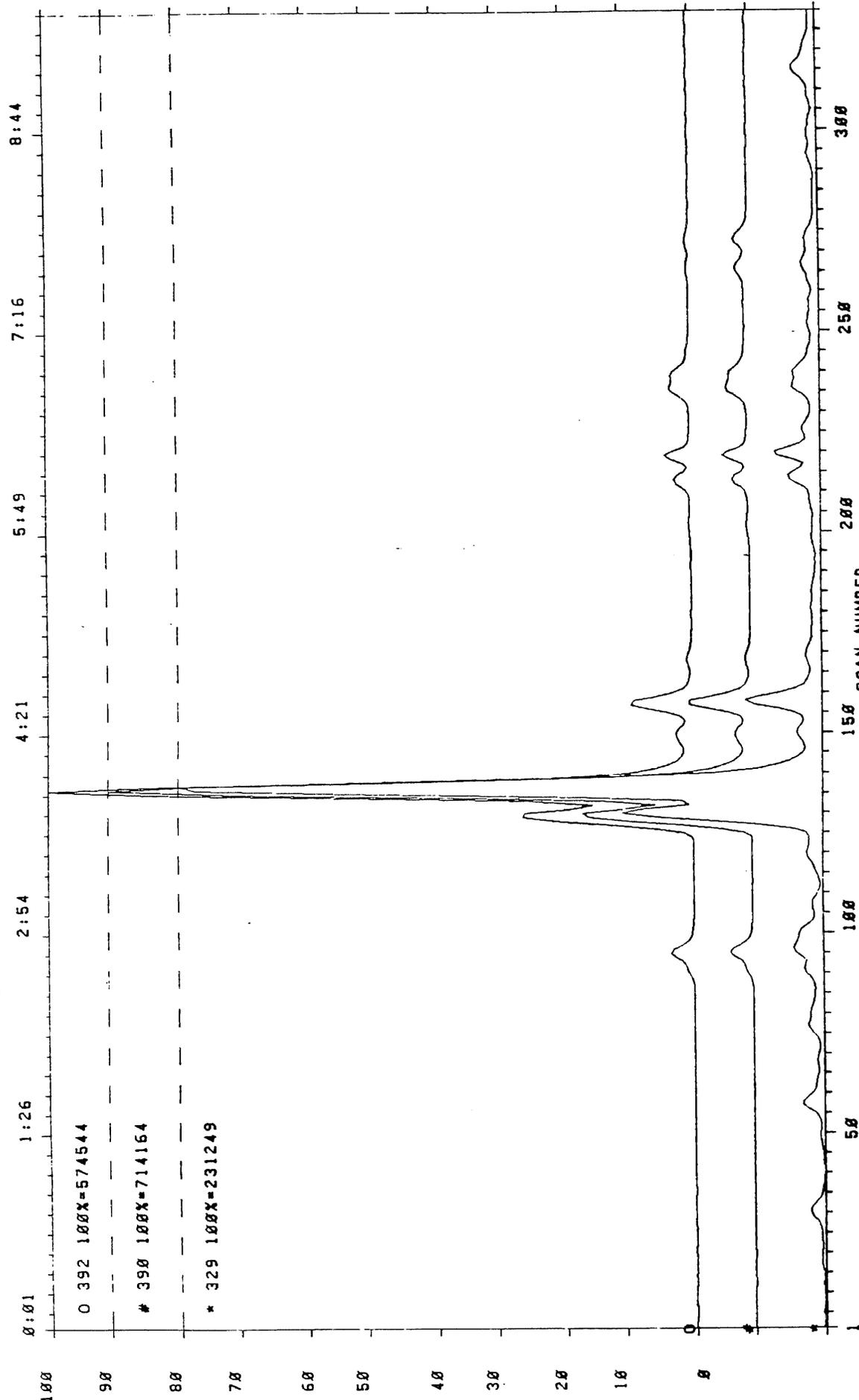


HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D2
FIGURE: 148

DATE: 02/23/84 TIME: 15:16

KRATOS MS25, DS55 SOFTWARE, RUN: TOR60042, WSU NAME: CHJ-21,30,49
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS

ION INTENSITY



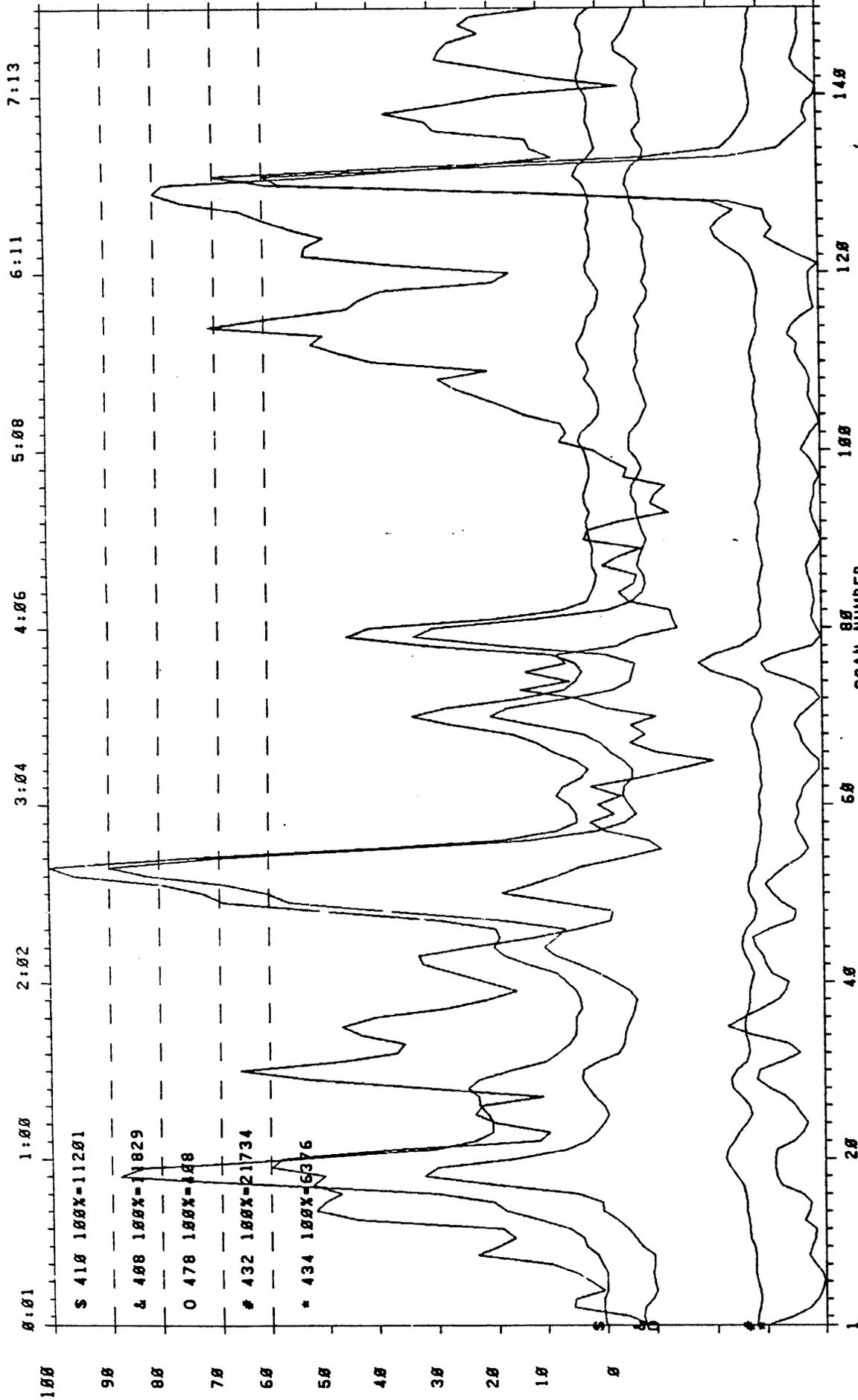
HRGC-LRHS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.262
FIGURE: 149

BREH. LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45425

DATE: 02/23/84 TIME: 15:25

KRATOS MS25, DATA SOFTWARE, RUN: TOR70041, WSU NAME: CHJ-21,30,49

SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS

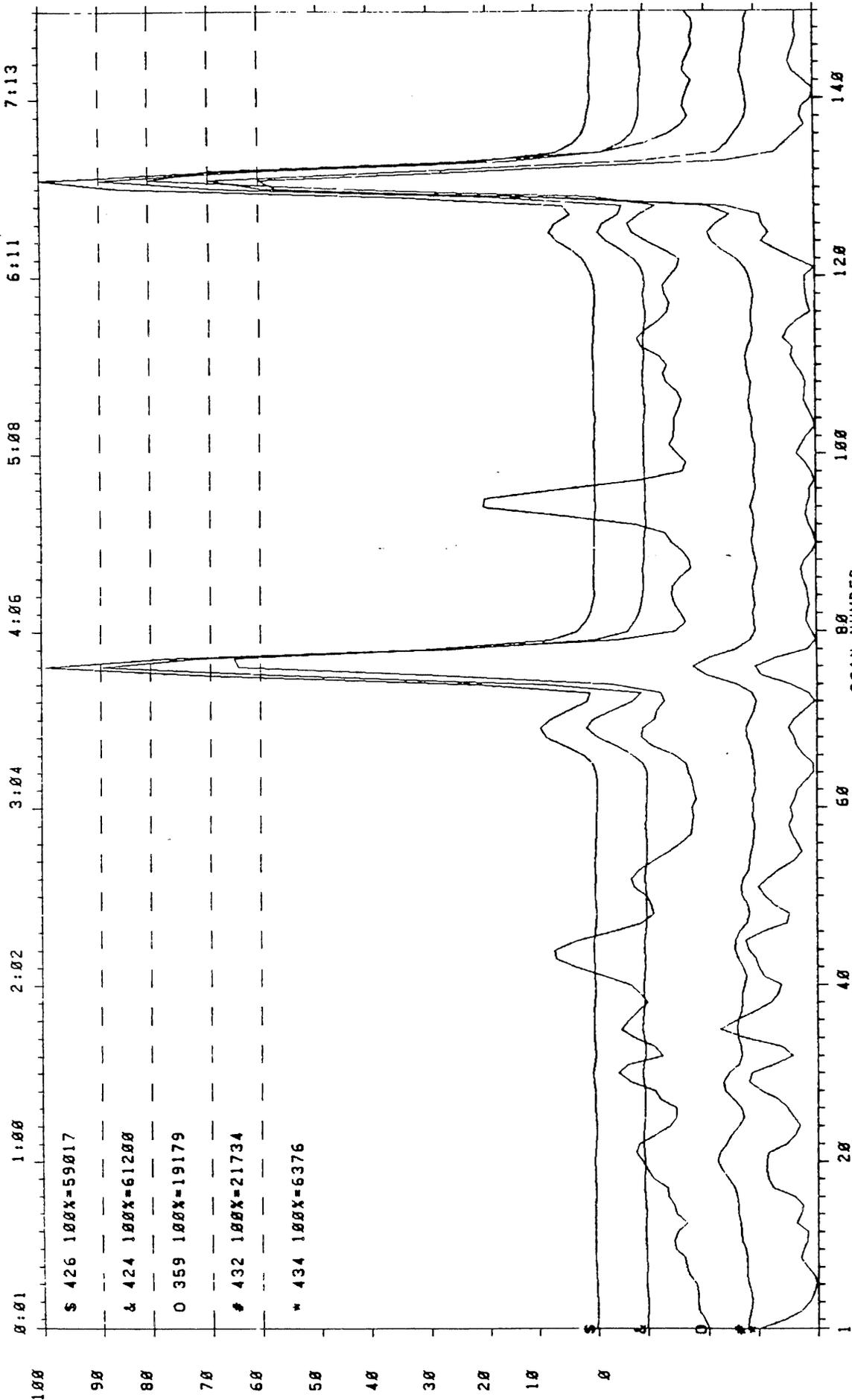


HGCC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2b2
FIGURE: 150

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 15:25

KRATOS MS25, DS55 SOFTWARE, RUN: TOR70041, WSU NAME: CHJ-21.30.49
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



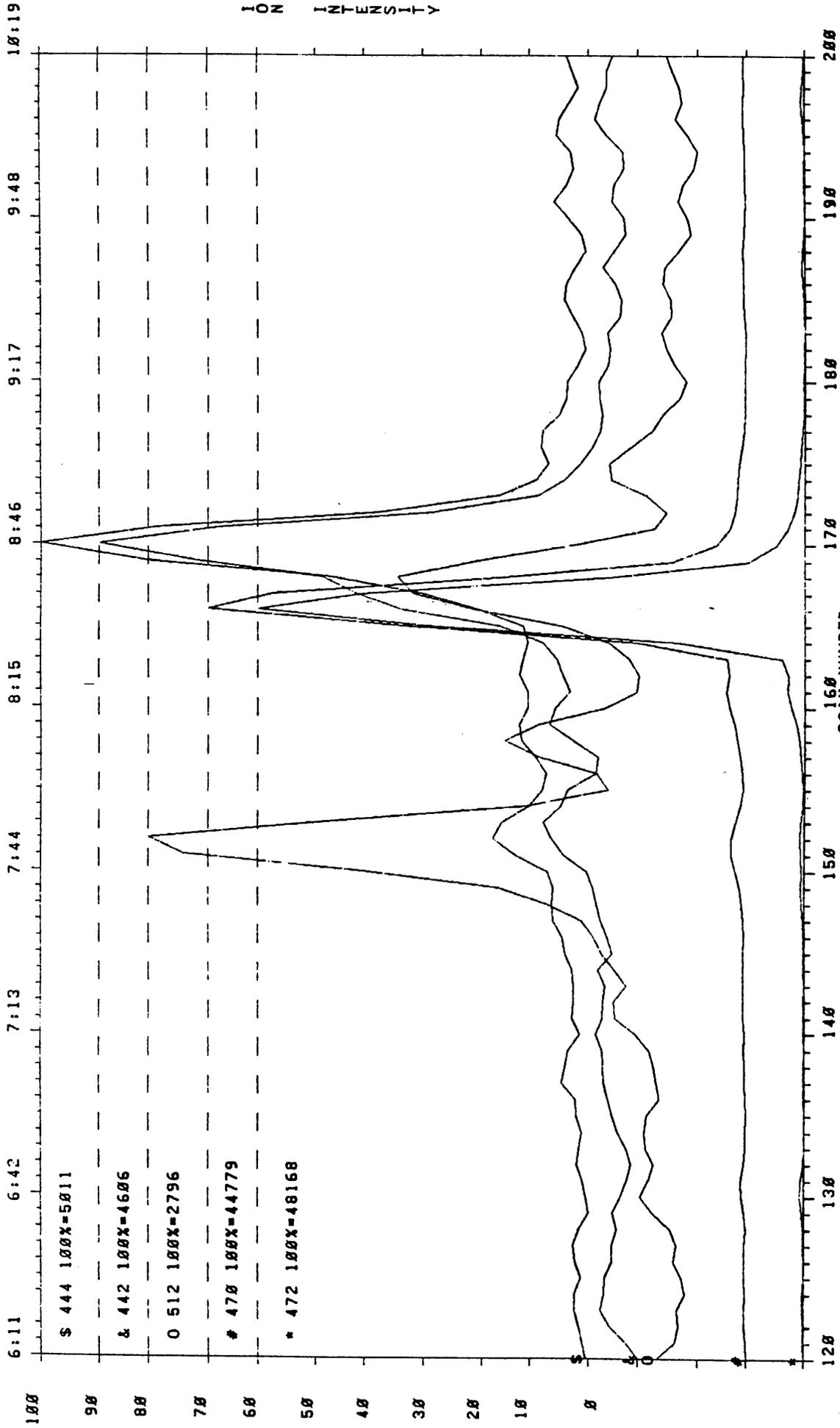
\$ 426 100X=59017
& 424 100X=61200
O 359 100X=19179
432 100X=21734
* 434 100X=6376

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D2
FIGURE: 151

BREWER LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 15:39

KRATOS MS25, DS55 SOFTWARE, RUN: TOR80048, WSU NAME: CHJ-21,30,49
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D2
FIGURE: 152

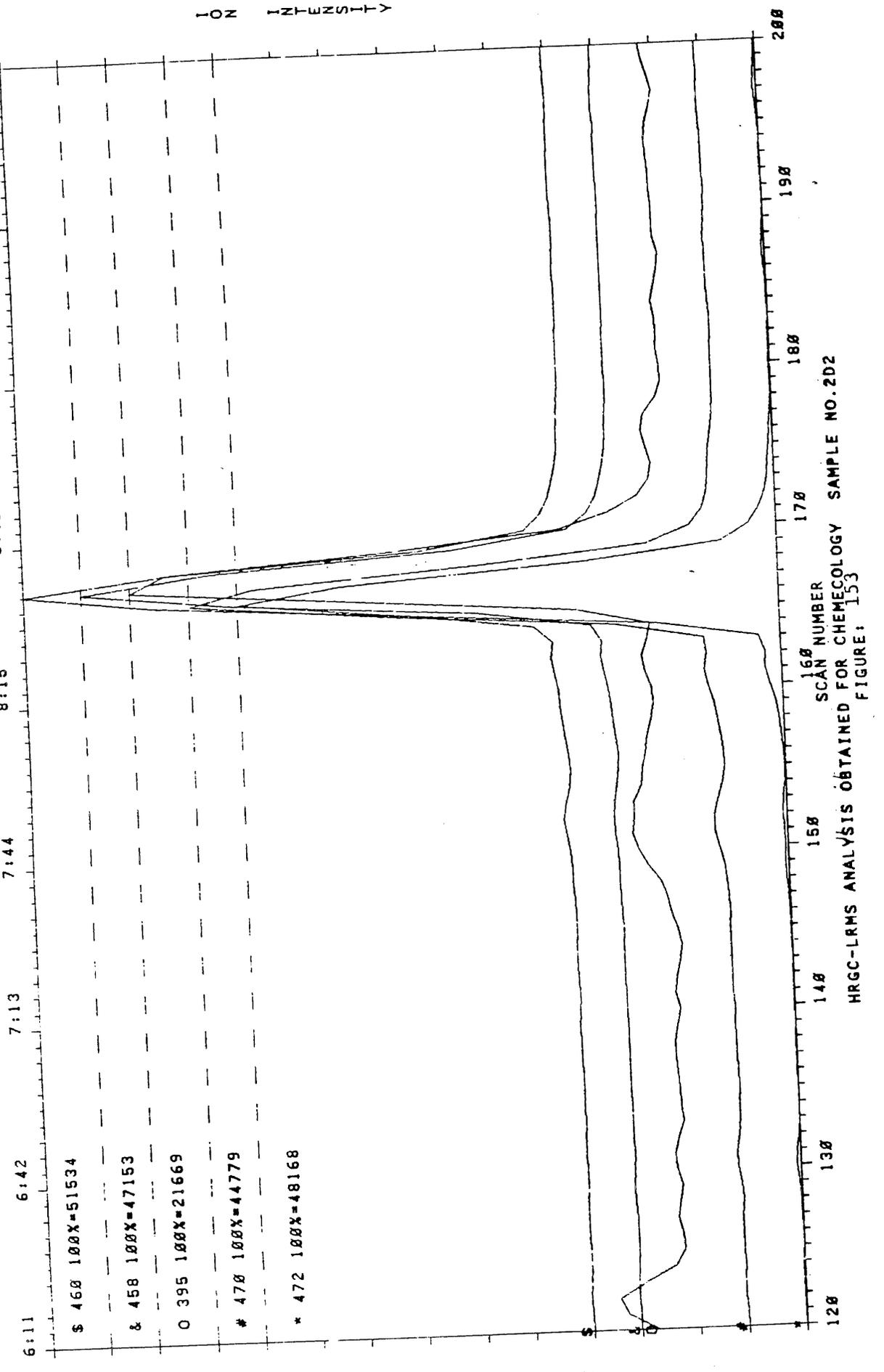
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 15:39

WSU NAME: CHJ-21.30.49

KRATOS MS25, DS55 SOFTWARE, RUN: TOR80048, WSU NAME: CHJ-21.30.49

SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



\$ 460 100X=51534

& 458 100X=47153

O 395 100X=21669

470 100X=44779

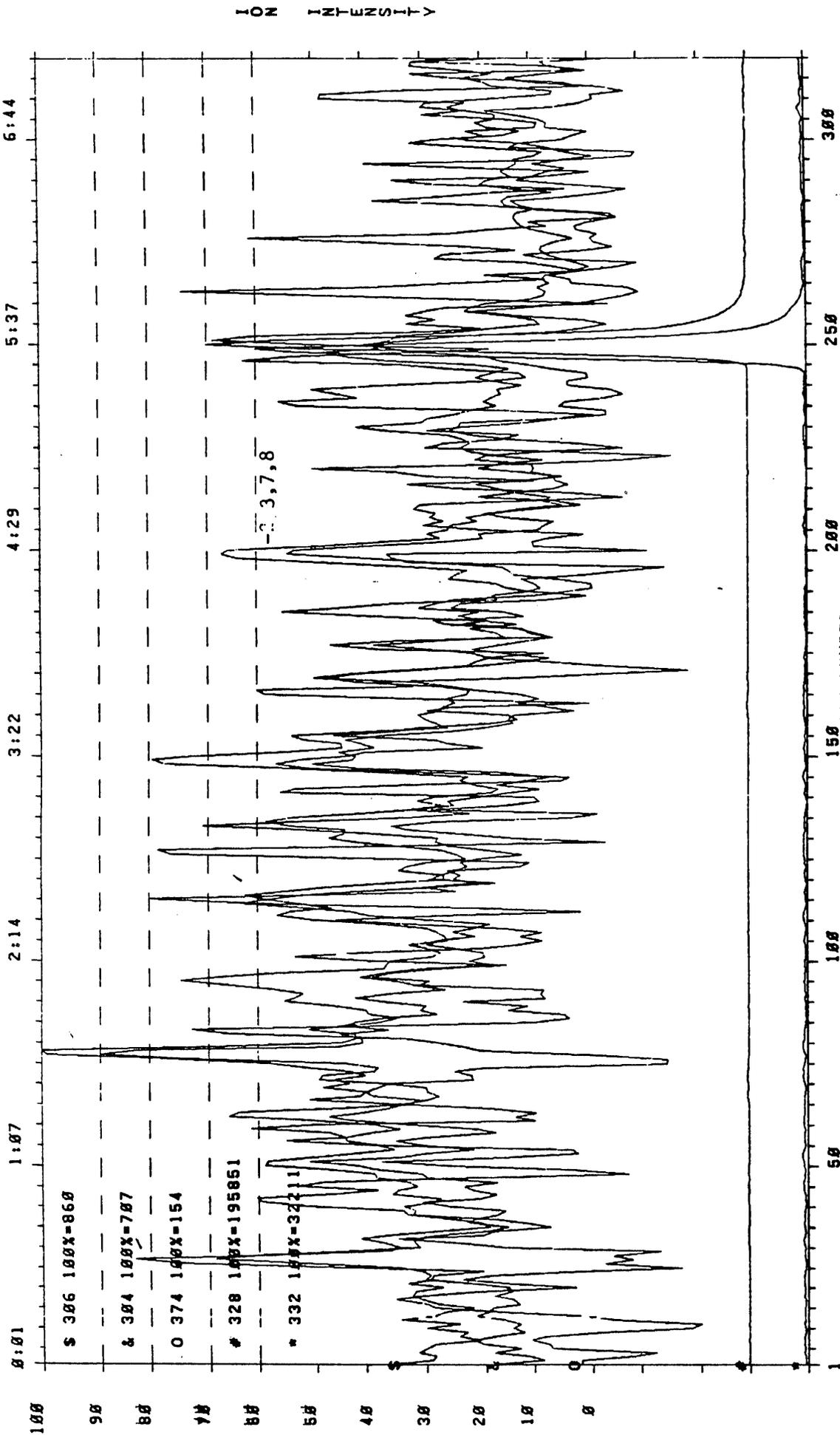
* 472 100X=48168

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 2D2
FIGURE: 153
SCAN NUMBER 153

ANALYZER: KRATOS MS25, DS55 SC: YARE, RUN: TOR40051, WSU NAME: CHJ-22

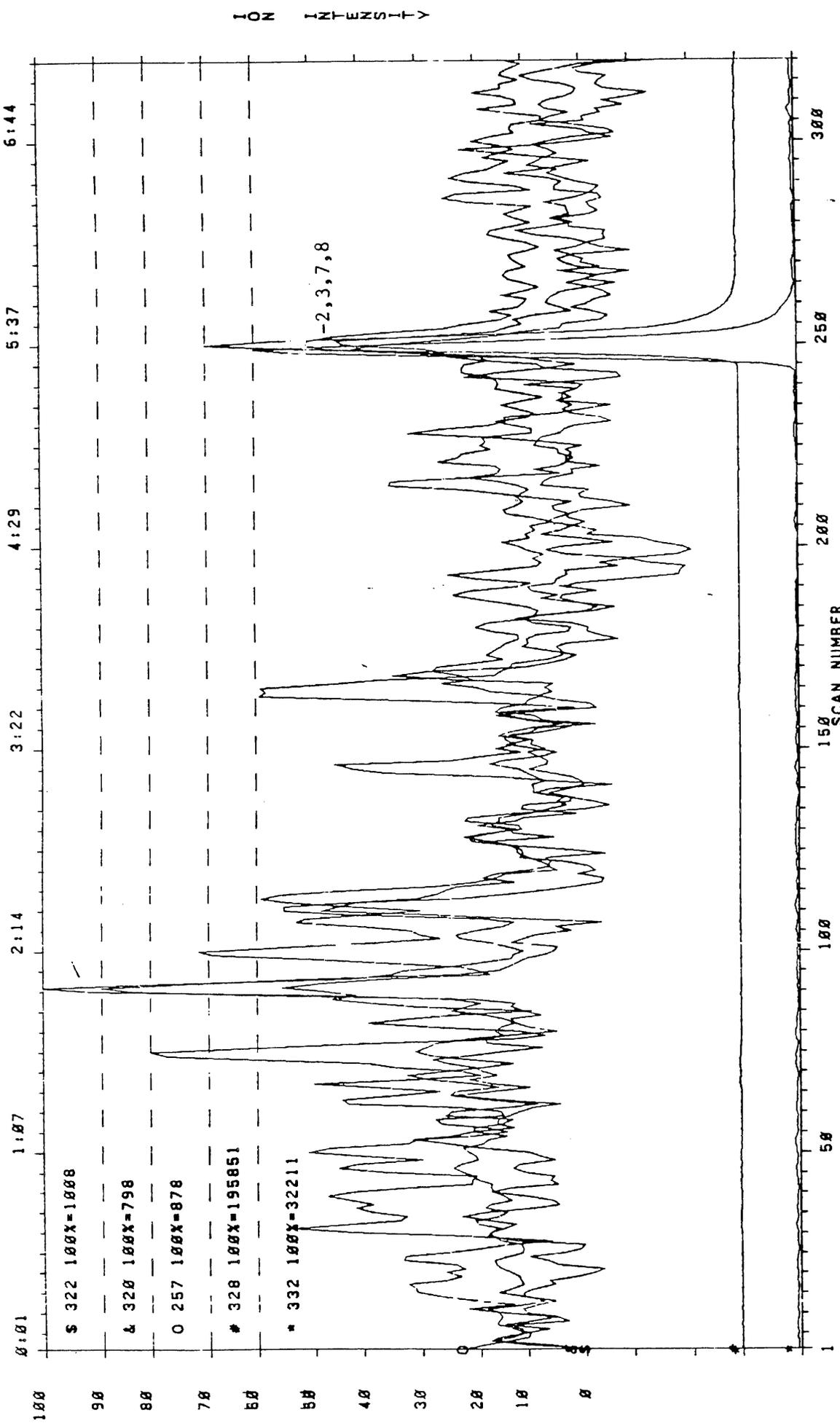
DATE: 02/23/84, TIME: 15:19

SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



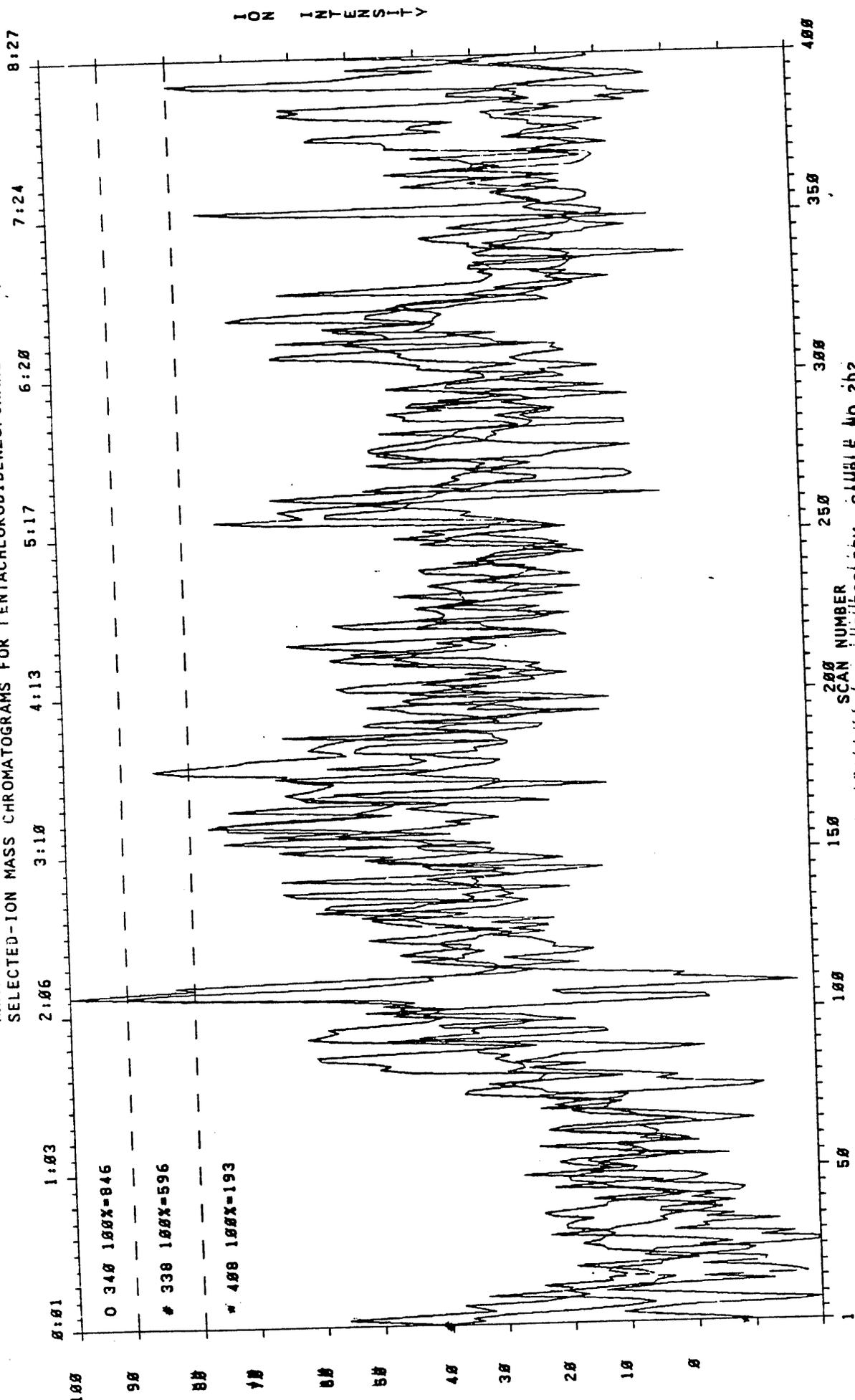
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D2
FIGURE: 154

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/84 TIME: 16:18
KRATOS MS25, DS55 SOFTWARE, RUN: TOR40051, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



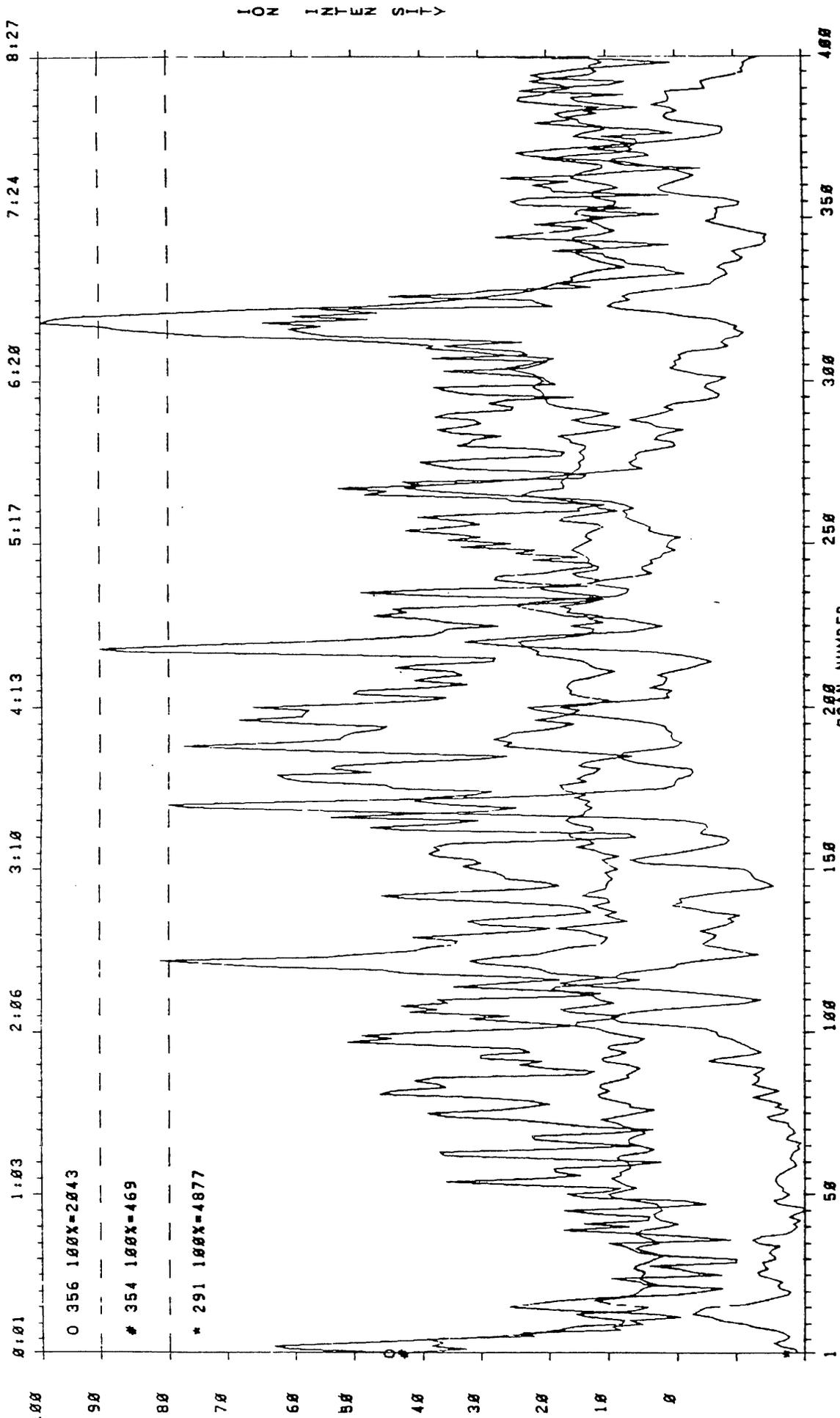
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.262
FIGURE: 155

BRERI 30RATS - NIGHT GATE U ERGITY DAYTCI, OHIO 45430
DATE: 02/23/84 TIME: 16:27
KRATOS MS25, DSS5 SOFTWARE, RUN: TOR50042, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



200 NUMBER
SCAN NUMBER SAMPLE NO.202
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY
FIGURE: 156

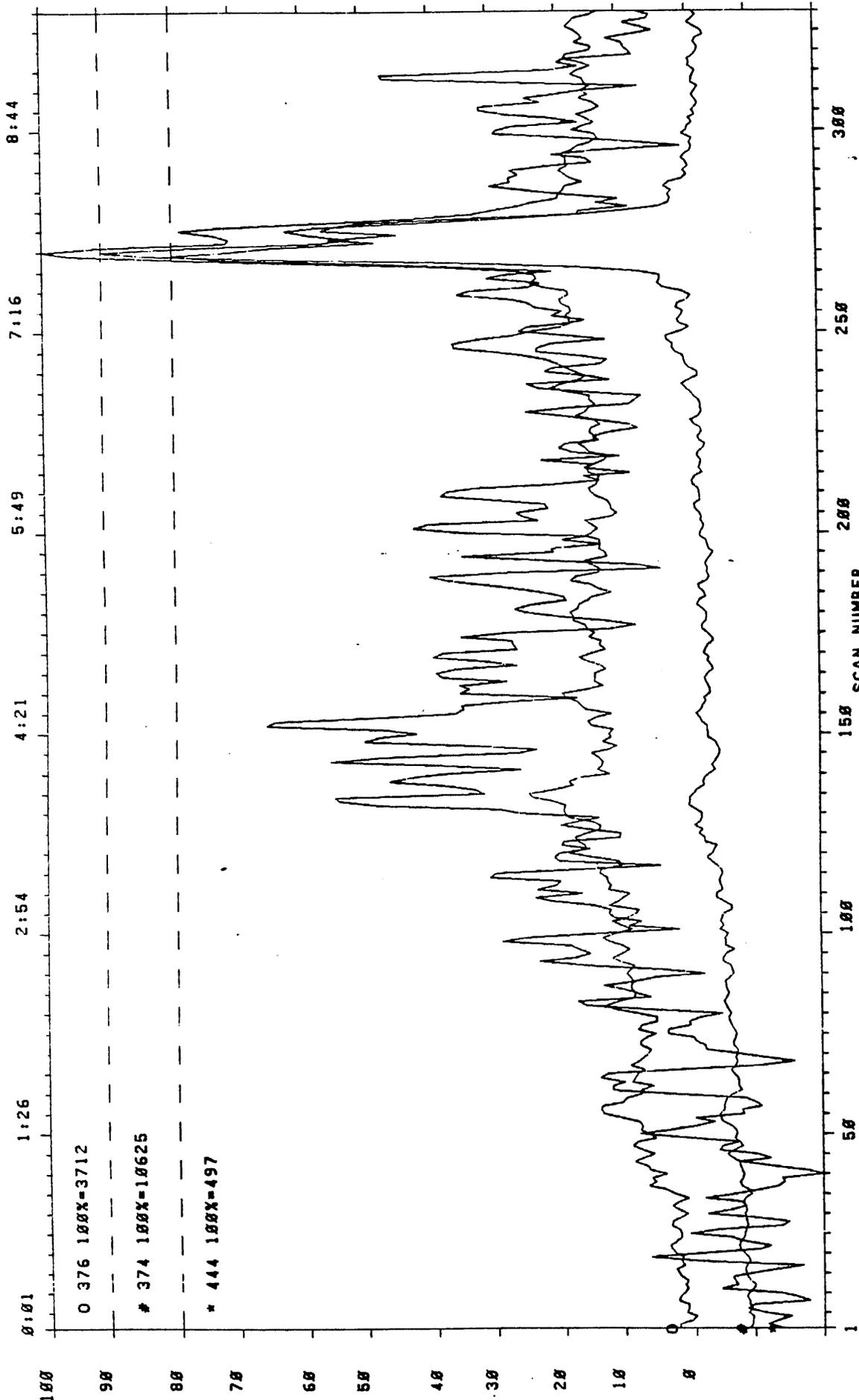
BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/84 TIME: 16:27
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50042, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D2
FIGURE: 157

BRCHD BORATE Y - EIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 02/23/84 TIME: 16:37
KRATON MS25, DS05 SOFTWARE, RUN: TOR60043, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS

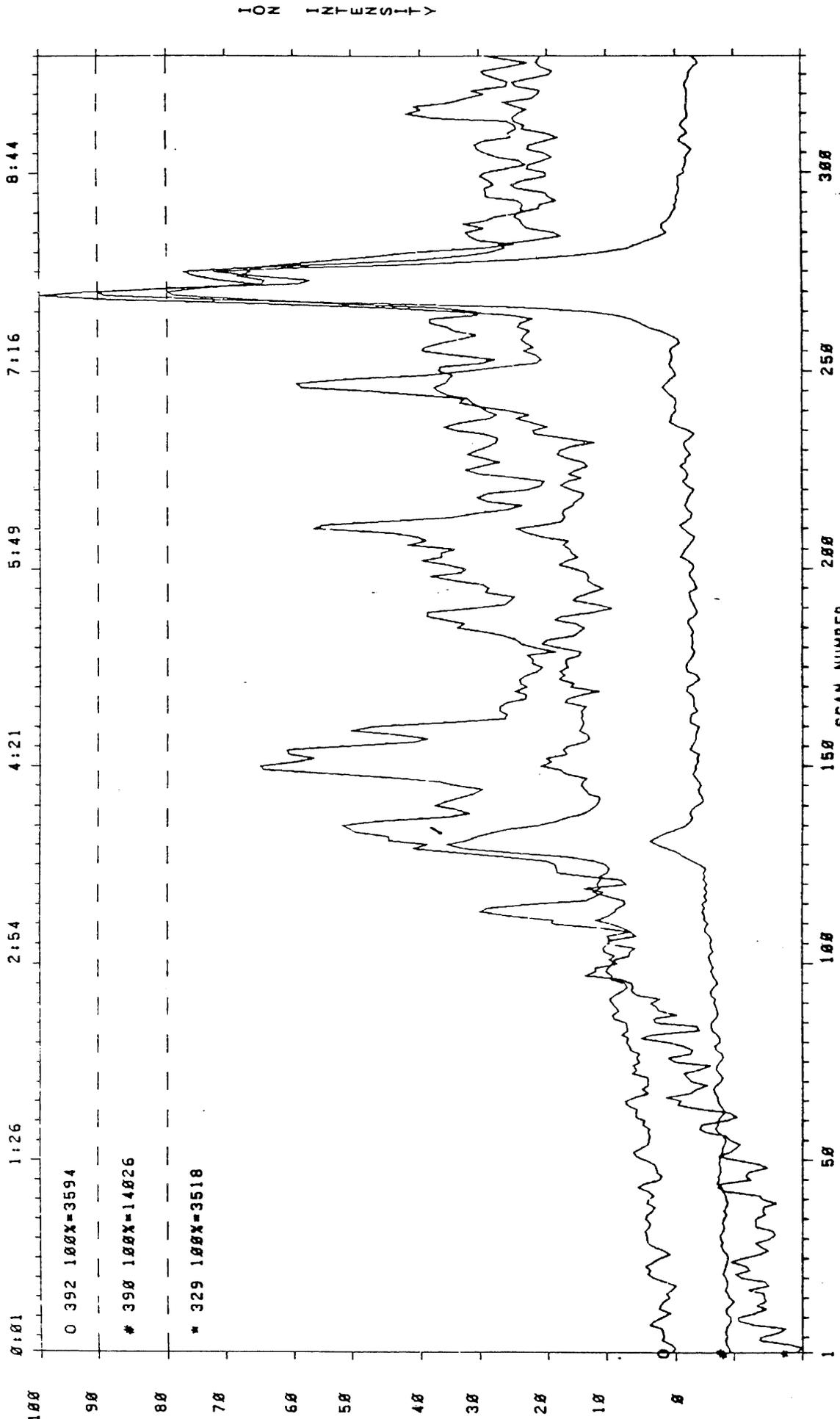


0 376 100X=3712
374 100X=10625
* 444 100X=497

100 90 80 70 60 50 40 30 20 10 0 1 50 100 150 200 250 300

MASS-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202
FIGURE 158

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO. 4543E
DATE: 02/23/84 TIME: 16:37
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60043, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS

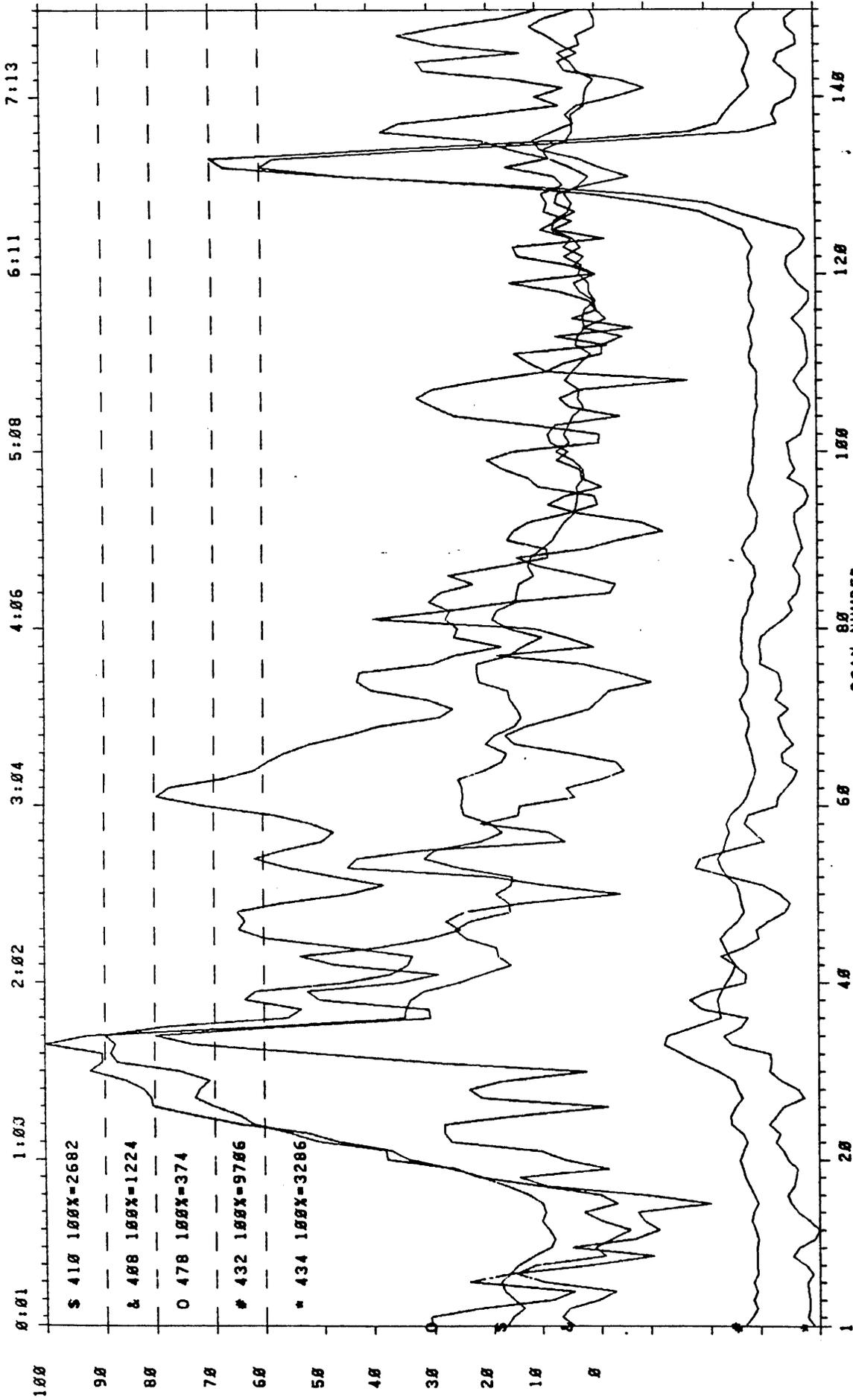


HRC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202
FIGURE: 159

DATE: 02/23/ TIME: 16:56

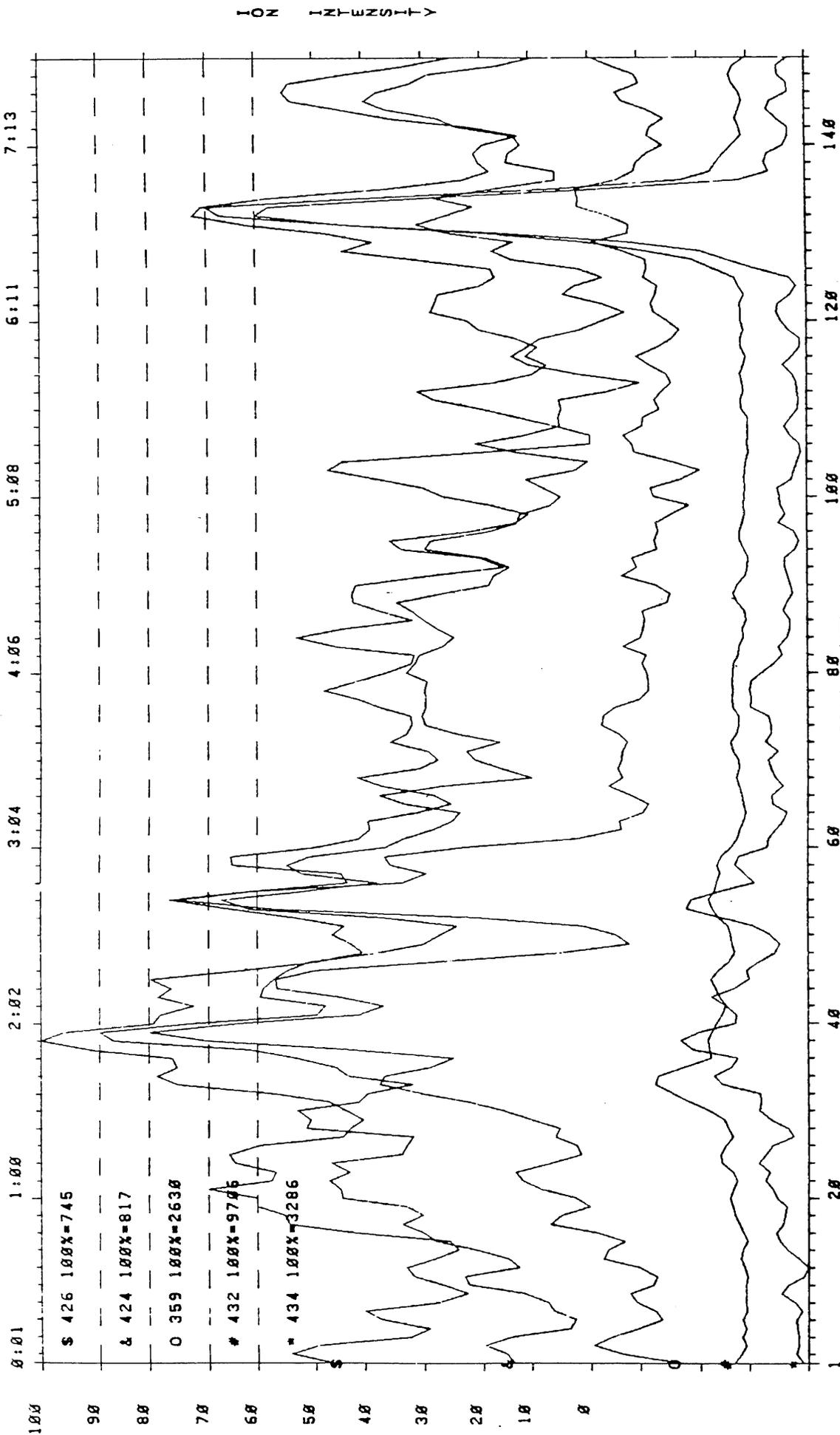
KRATOS MS25, DSSC SOFTWARE, RUN: TOR70042, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS

ION INTENSITY



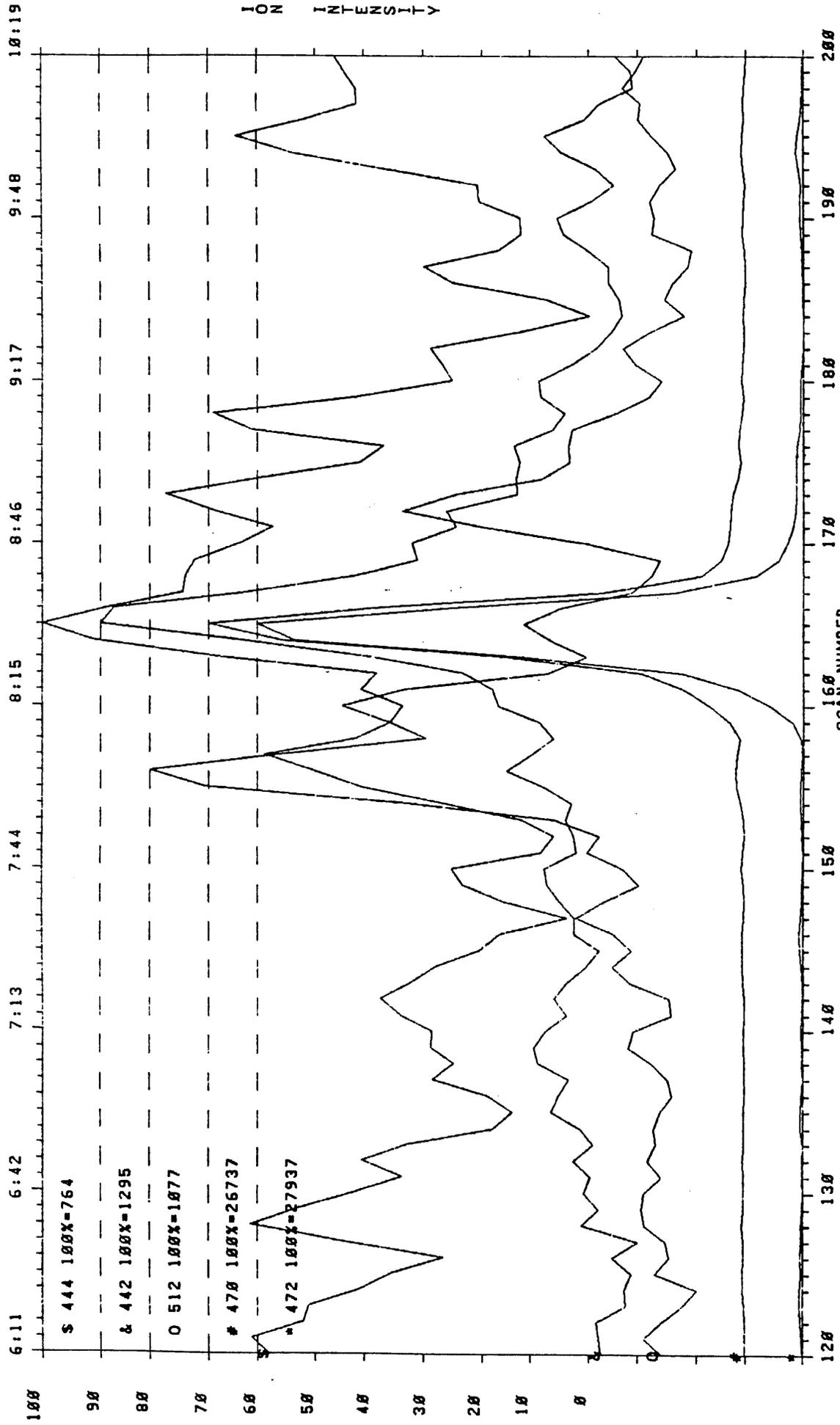
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE No. 262
FIGURE: 160

DATE: 02/23/84 TIME: 16:46
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70042, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



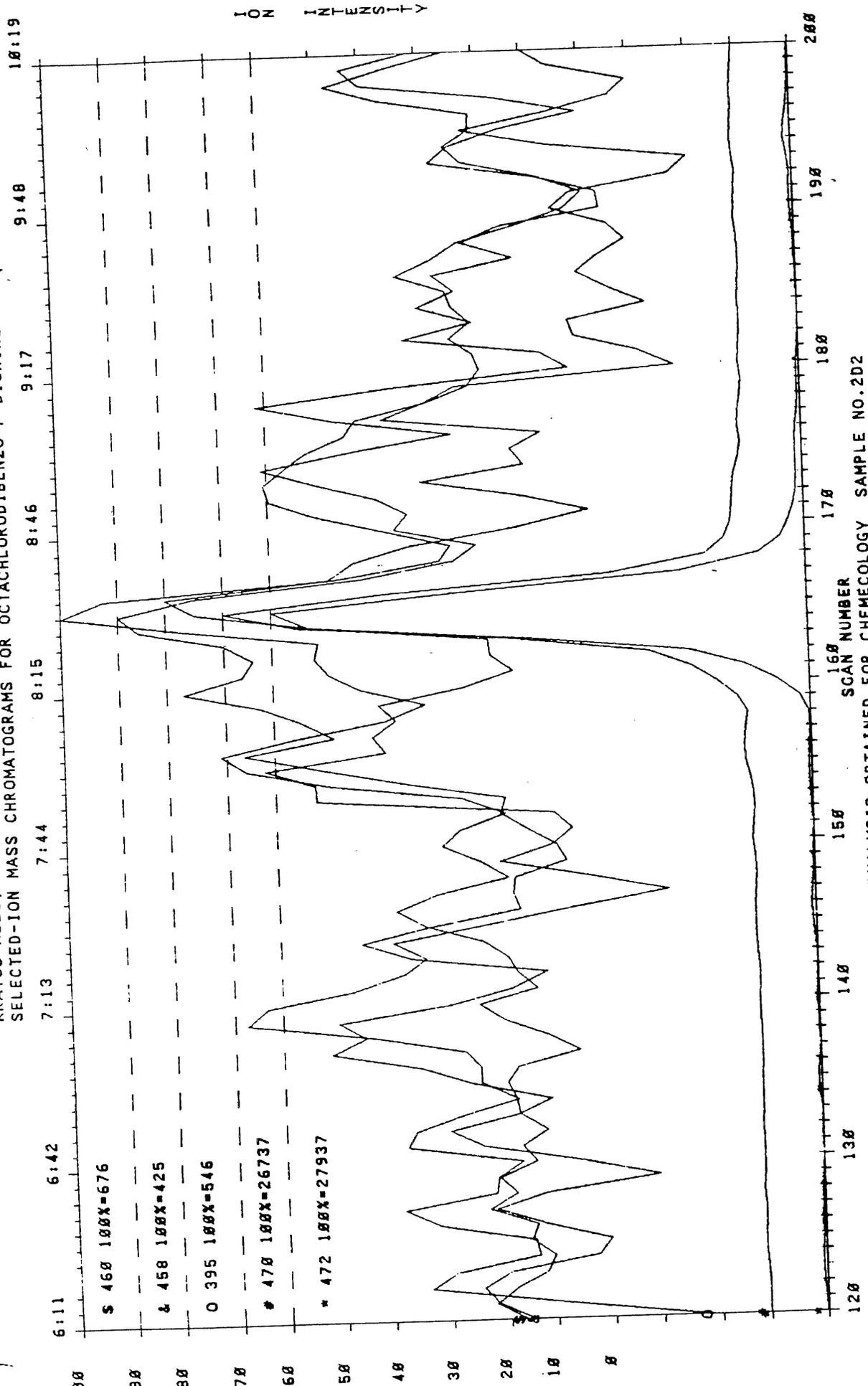
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 262
FIGURE 161

FREED LABORATORY - BRIGHAM YOUNG UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/77 TIME: 16:58
KRATOS MS25, DUESS SOFTWARE, RUN: TOR80049, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS



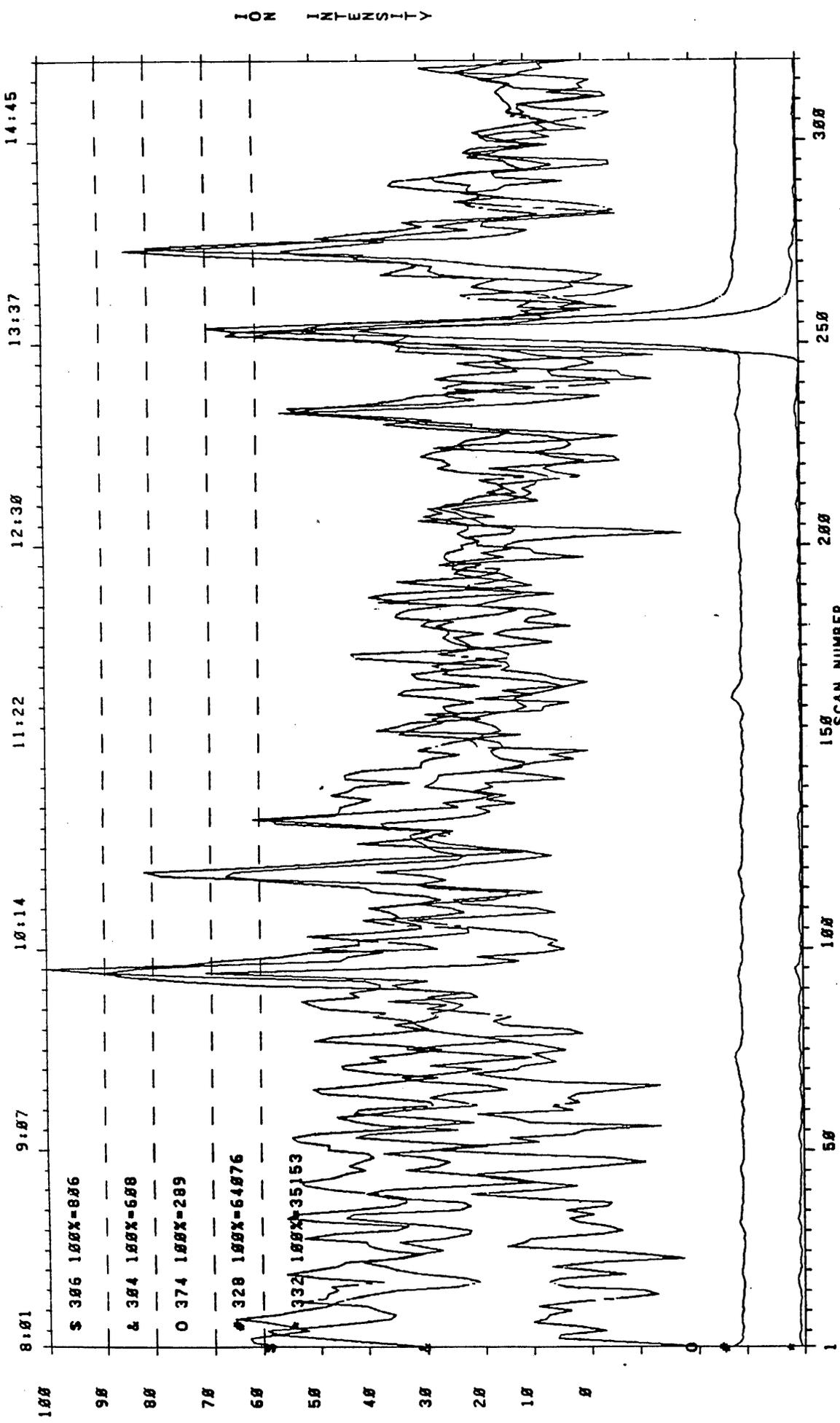
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202
FIGURE: 162

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 02/23/84 TIME: 16:58
KRATOS MS25, DS55 SOFTWARE, RUN: TOR80049, WSU NAME: CHJ-22
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



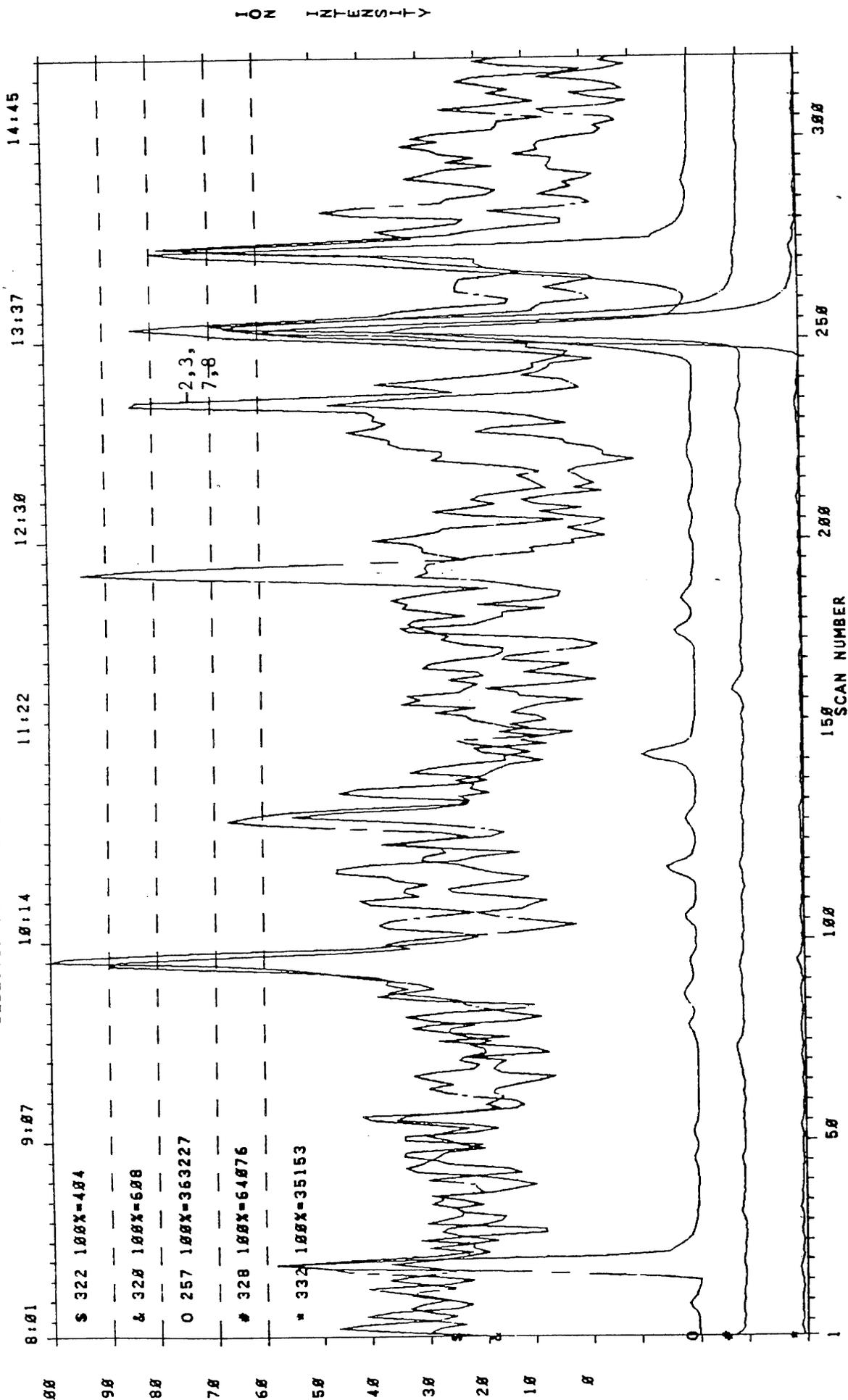
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D2
FIGURE: 163

BREWER LABORATORY - BRUSH STATE UNIVERSITY - DAYTON, OHIO 45432
 DATE: 04/14/84 TIME: 15:24
 KRATON MS25, DS55 SOFTWARE, RUN: TOF40002, WSU NAME: CHJ-46.74
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



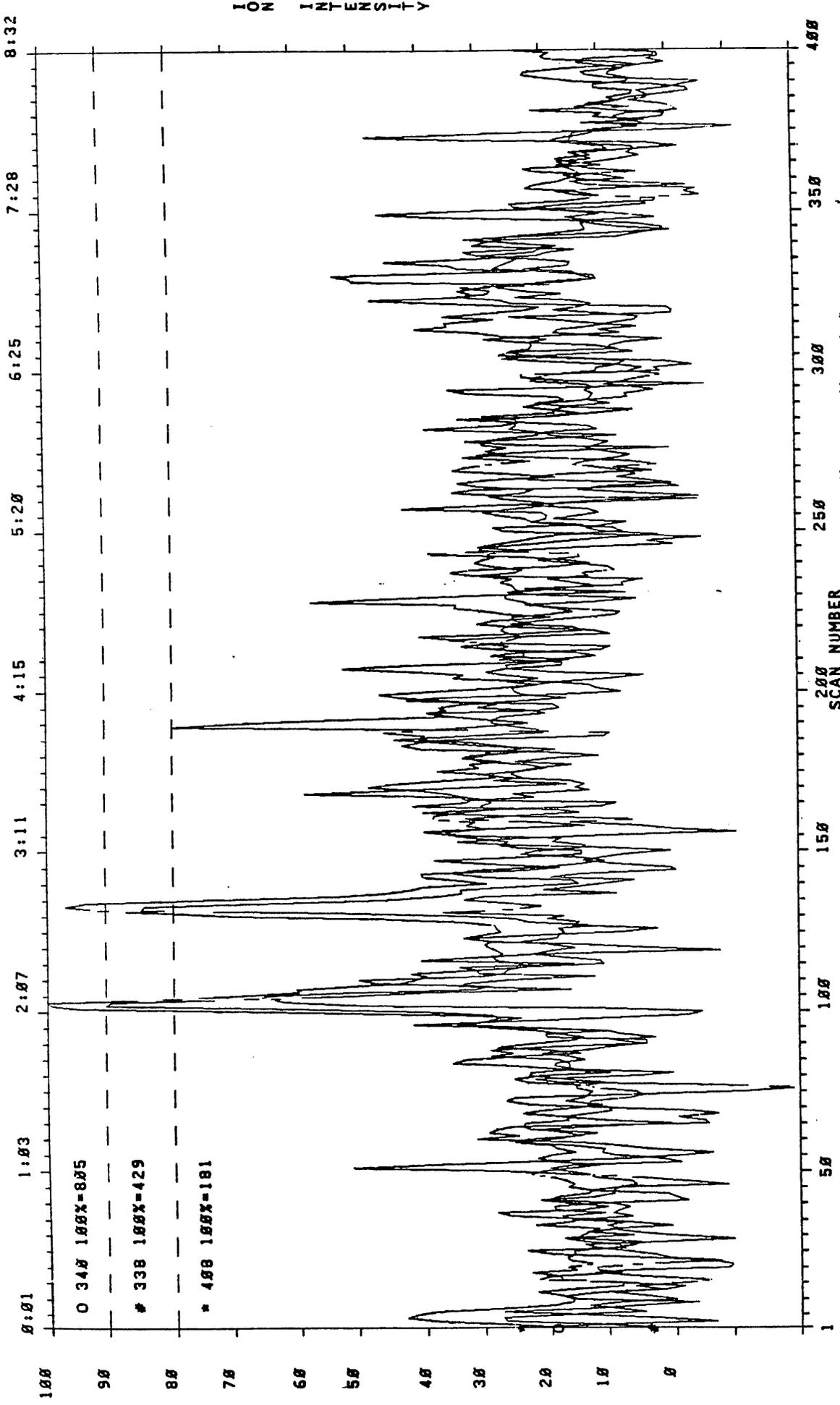
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2BI-M5-F
 FIGURE: 264

BREHM LABORATORY WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 04/10/84 TIME: 15:24
 KRATOS MS25, DS55 SOFTWARE, RUN: TOF40002, WSU NAME: CHJ-46,74
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



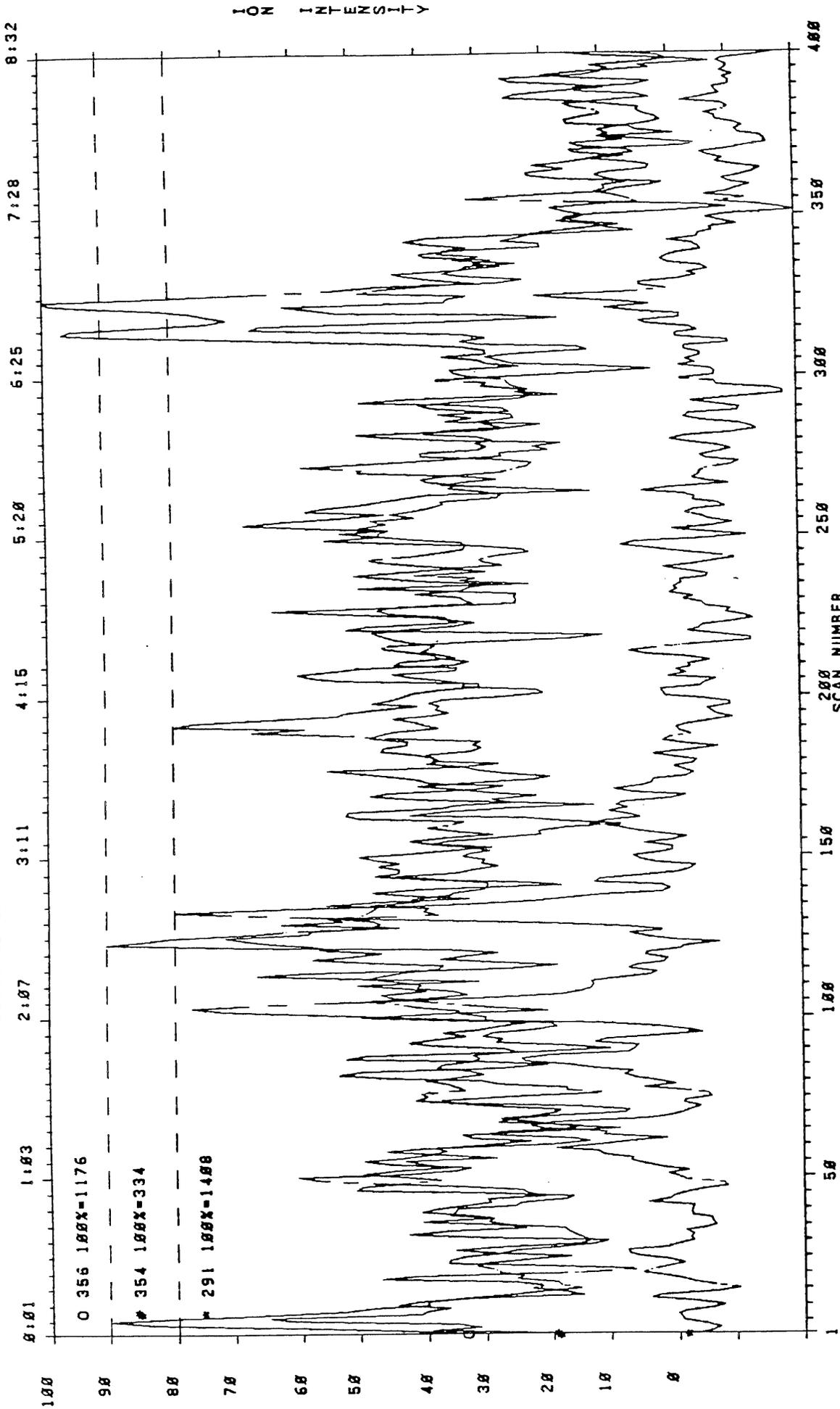
158 SCAN NUMBER
 HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D1-MS-F
 FIGURE: 265

BREHLL LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45436
 DATE: 04/10/ TIME: 15:33
 KRATOS MS25, DS55 SOFTWARE, RUN. IOF50002, WSU NAME: CHJ-46,74
 SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



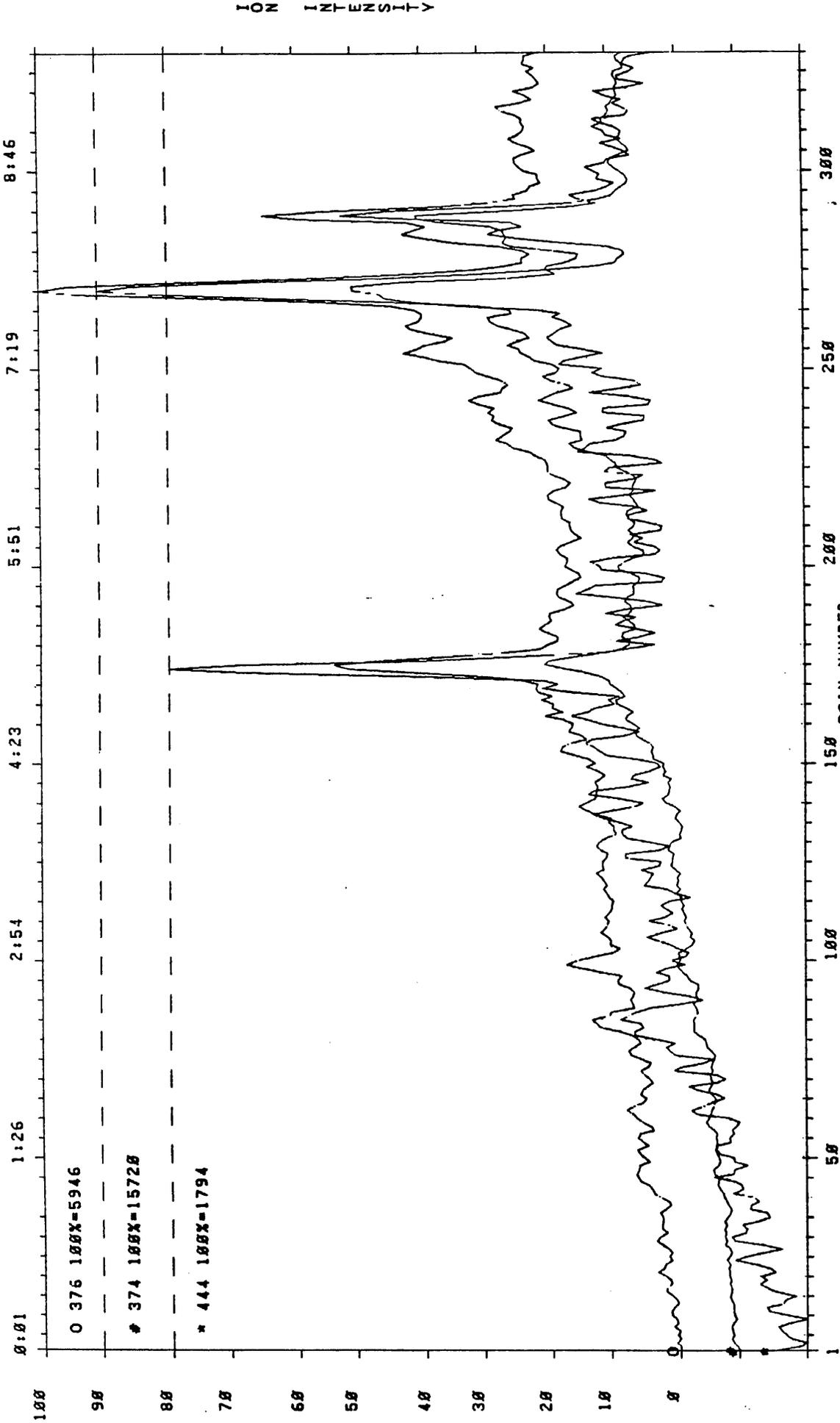
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO. 201-M5-F
 FIGURE: 266

DATE: 04/10/84 TIME: 15:33
KRATOS MS25, DS55 SOFTWARE, RUN: TOF50002, WSU NAME: CHJ-46,74
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



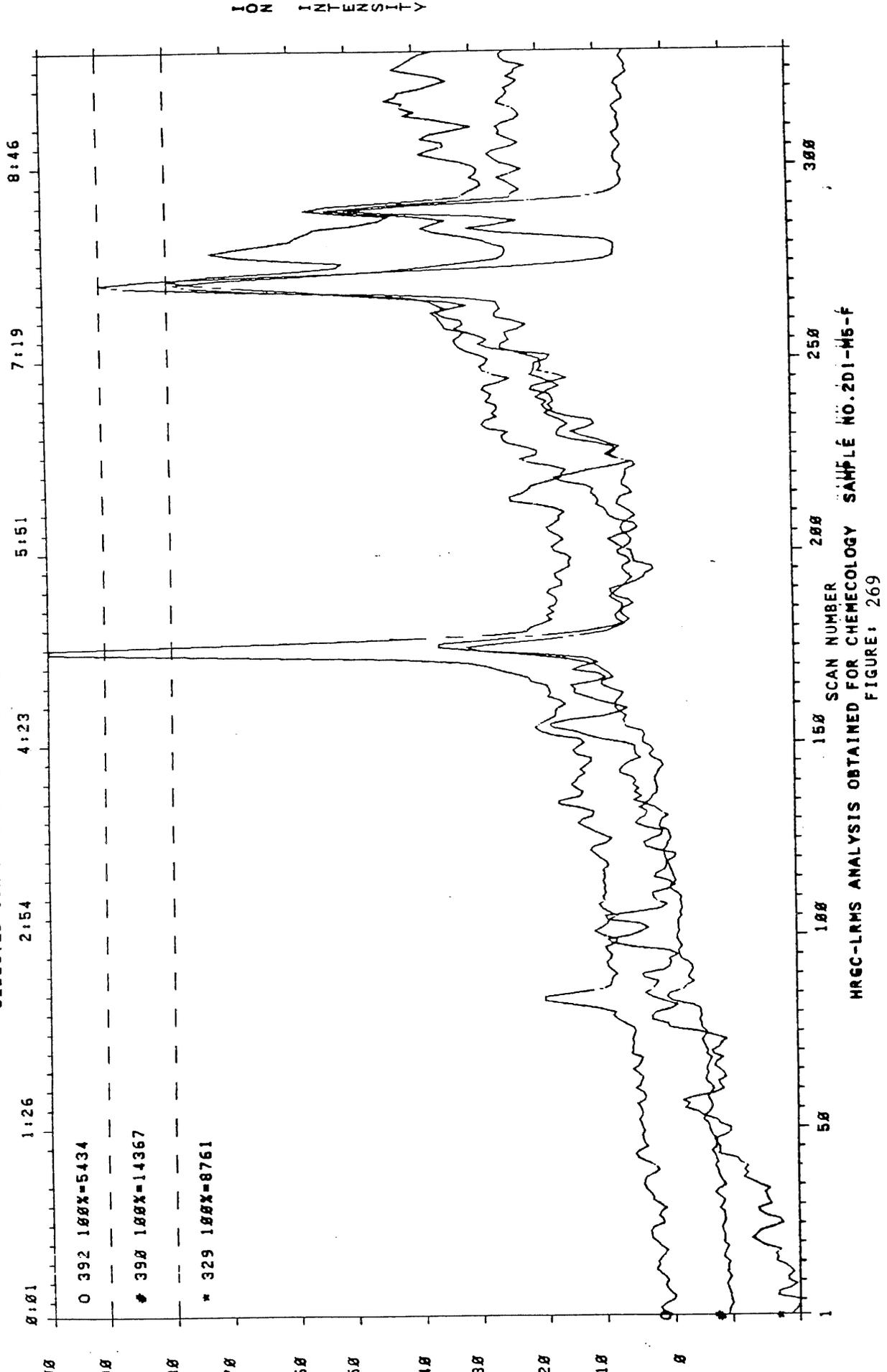
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D1-M5-F
FIGURE: 267

BREHA LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 04/10/84 TIME: 15:43
KRATOS MS25, DS55 SOFTWARE, RUN: TOF60002, WSU NAME: CHJ-46.74
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



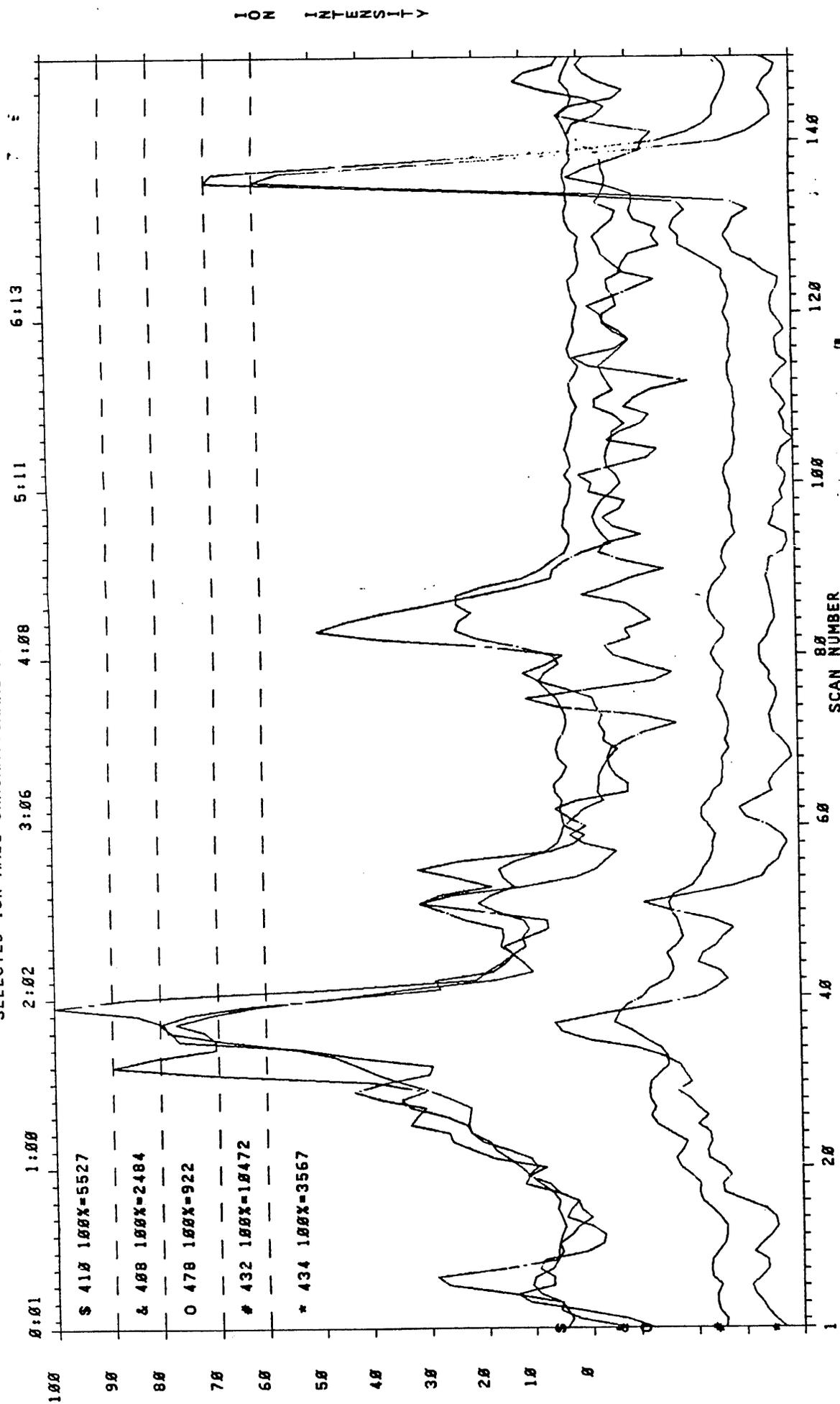
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D1-M5-F
FIGURE: 268

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45433
DATE: 04/10/84 TIME: 15:43
KRATOS MS25, DS55 SOFTWARE, RUN: TOF60002, WSU NAME: CHJ-46,74
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS



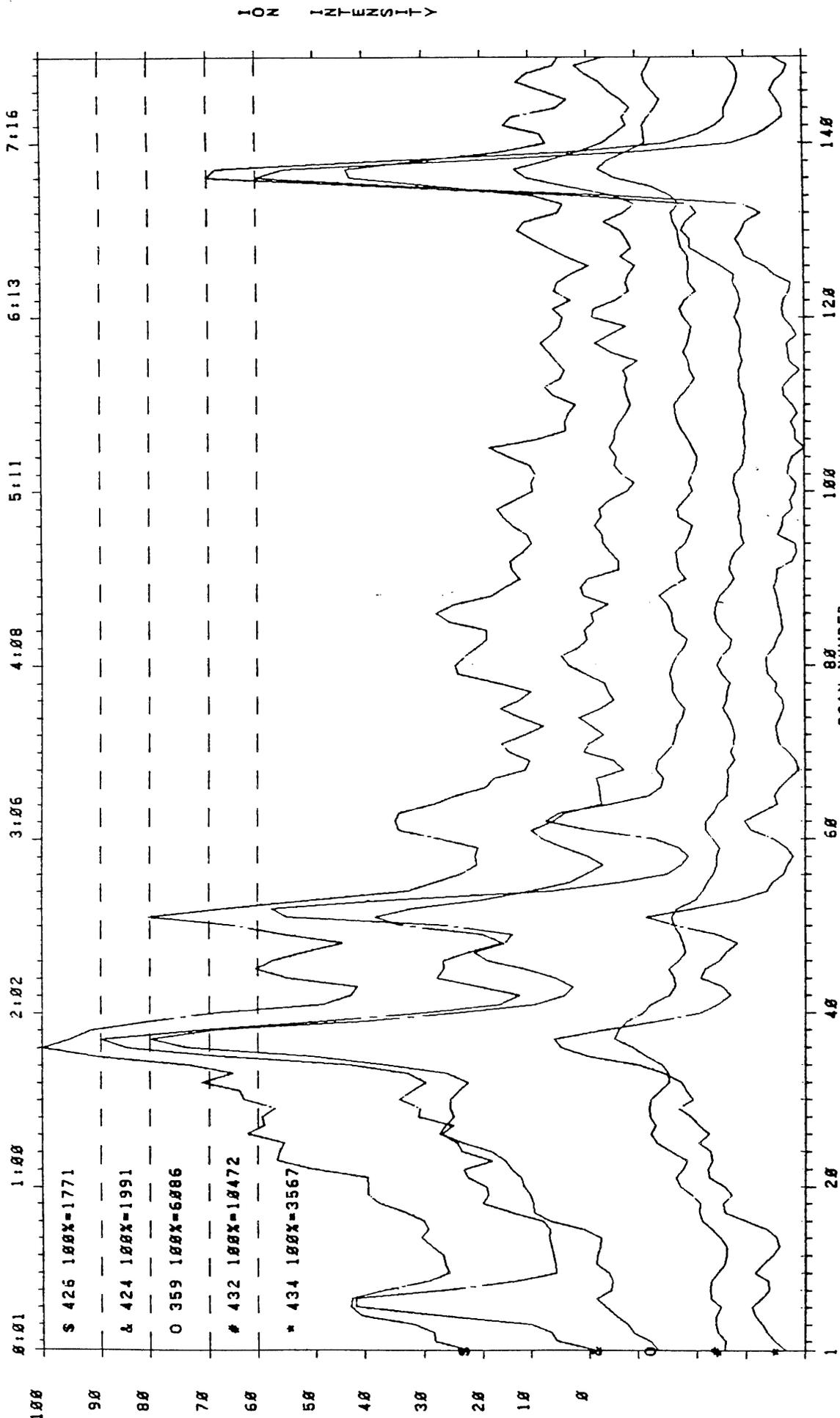
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 201-M5-F
FIGURE: 269

WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 04/10/84 TIME: 15:54
 KRATOS MS25, DS55 SOFTWARE, RUN: TOF7002, WSU NAME: CHJ-46,74
 SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



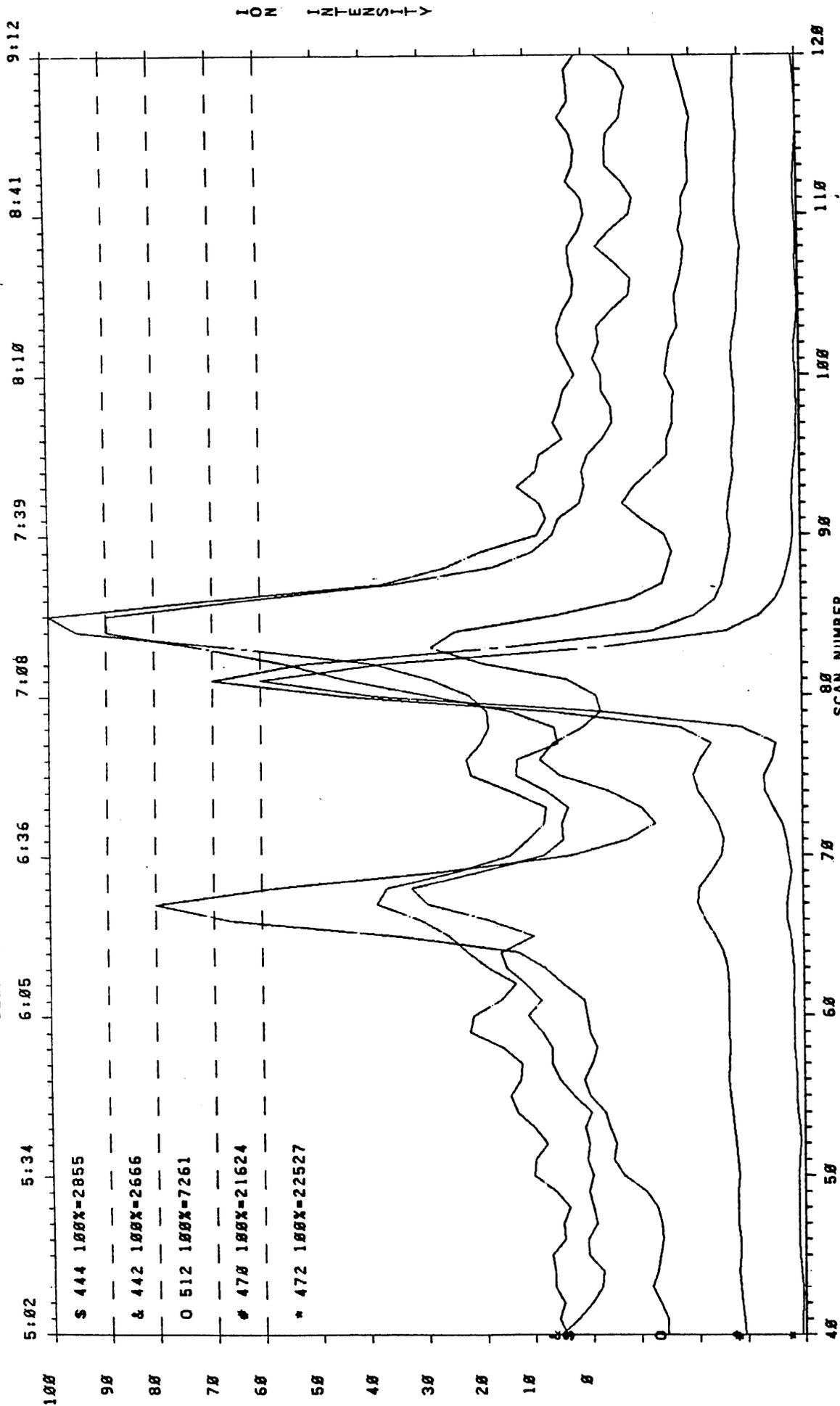
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D1-M5-F
 FIGURE: 270

BOEHRM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 04/10/84 TIME: 15:54
KRATOS MS25, DS55 SOFTWARE, RUN: TOF70002, WSU NAME: CHJ-46.74
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



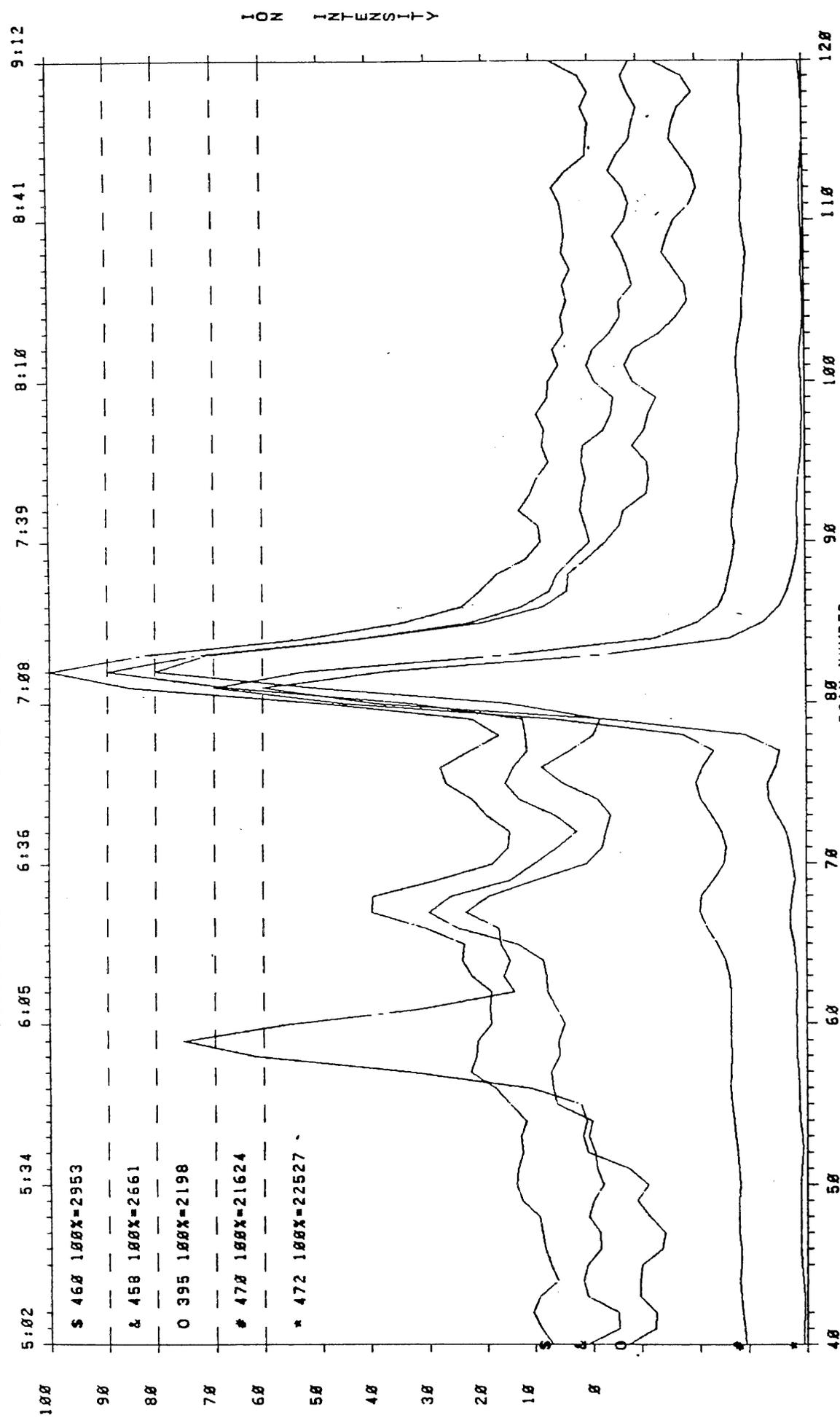
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2DI-M5-F
FIGURE: 271

BREHM LABORATORY - NIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 04/10/86 TIME: 16:04
KRATOS MS25, DS55 SOFTWARE, RUN: TOF80002, WSU NAME: CHJ-46,74
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 261-H5-F
FIGURE: 272

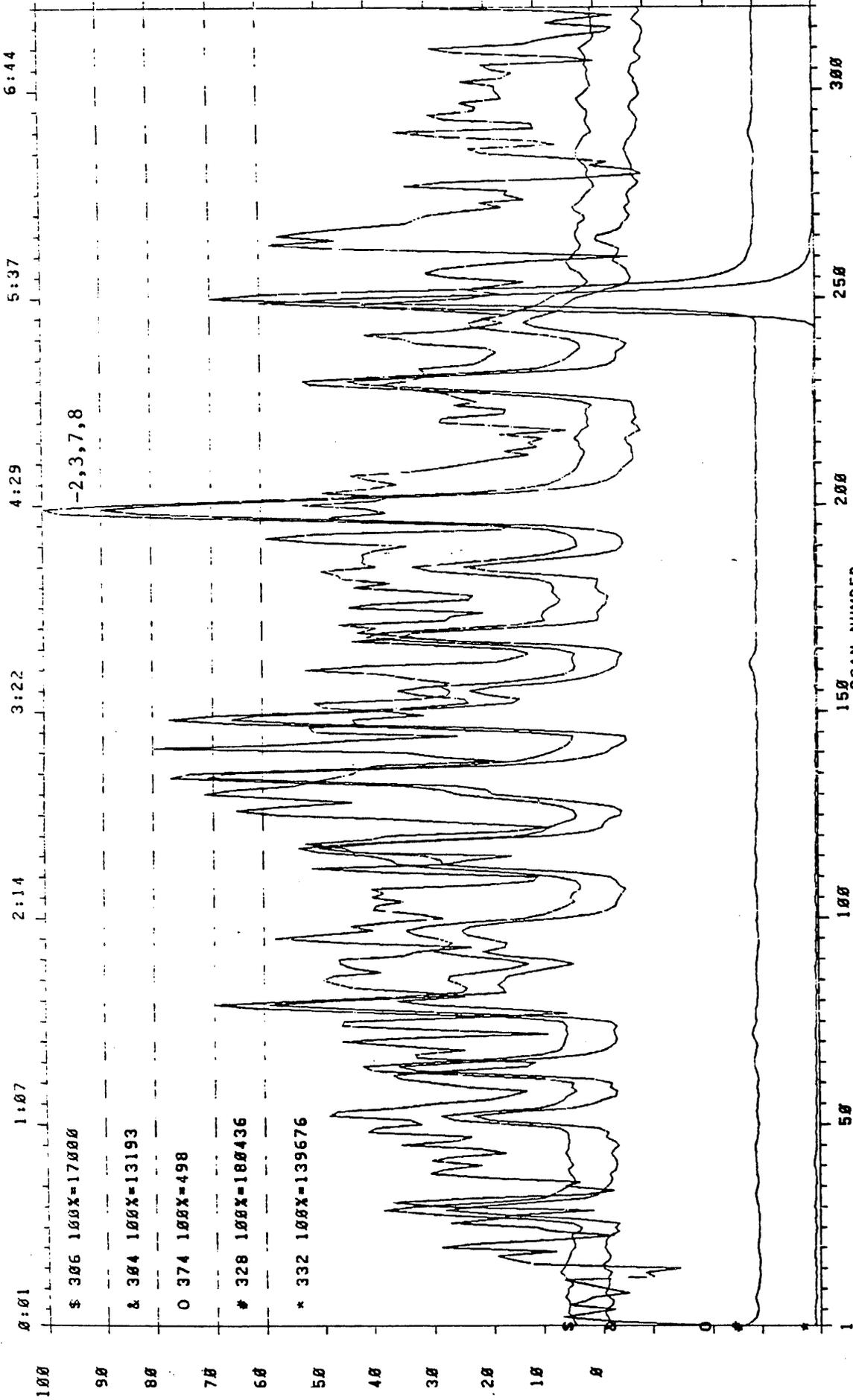
DATE: 04/10/84 TIME: 16:04
KRATOS MS25, DS55 SOFTWARE, RUN: TOF0002, WSU NAME: CHJ-46,74
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D1-M5-F
FIGURE: 273

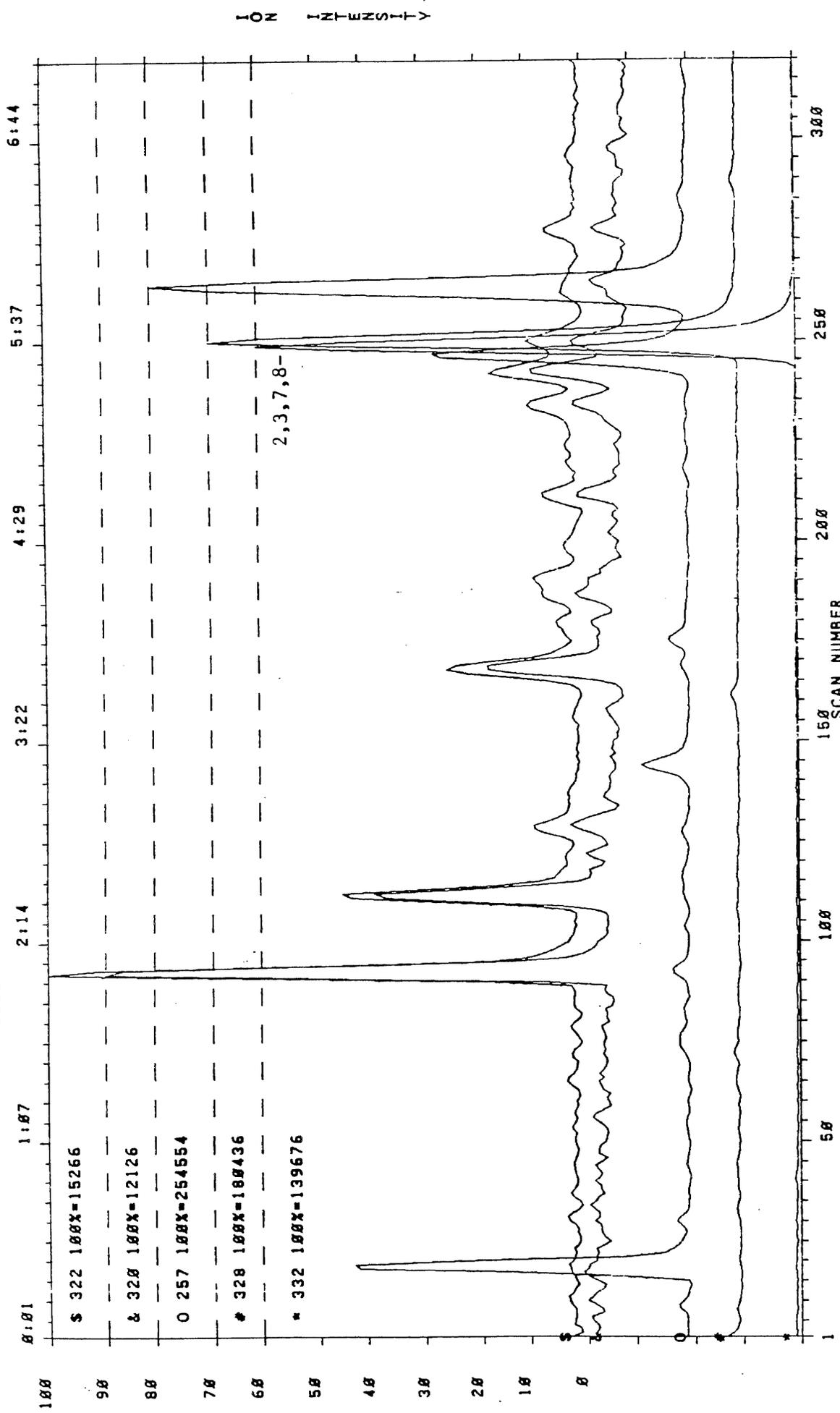
ION INTENSITY

GREENH LABORATORY - BRIGIT STATE UNIVERSITY - CAYLON, OHIO 45435
DATE: 03/02/ TIME: 13:20
REATOR: MS25, DS55 SOFTWARE, RUN: TOR40076, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



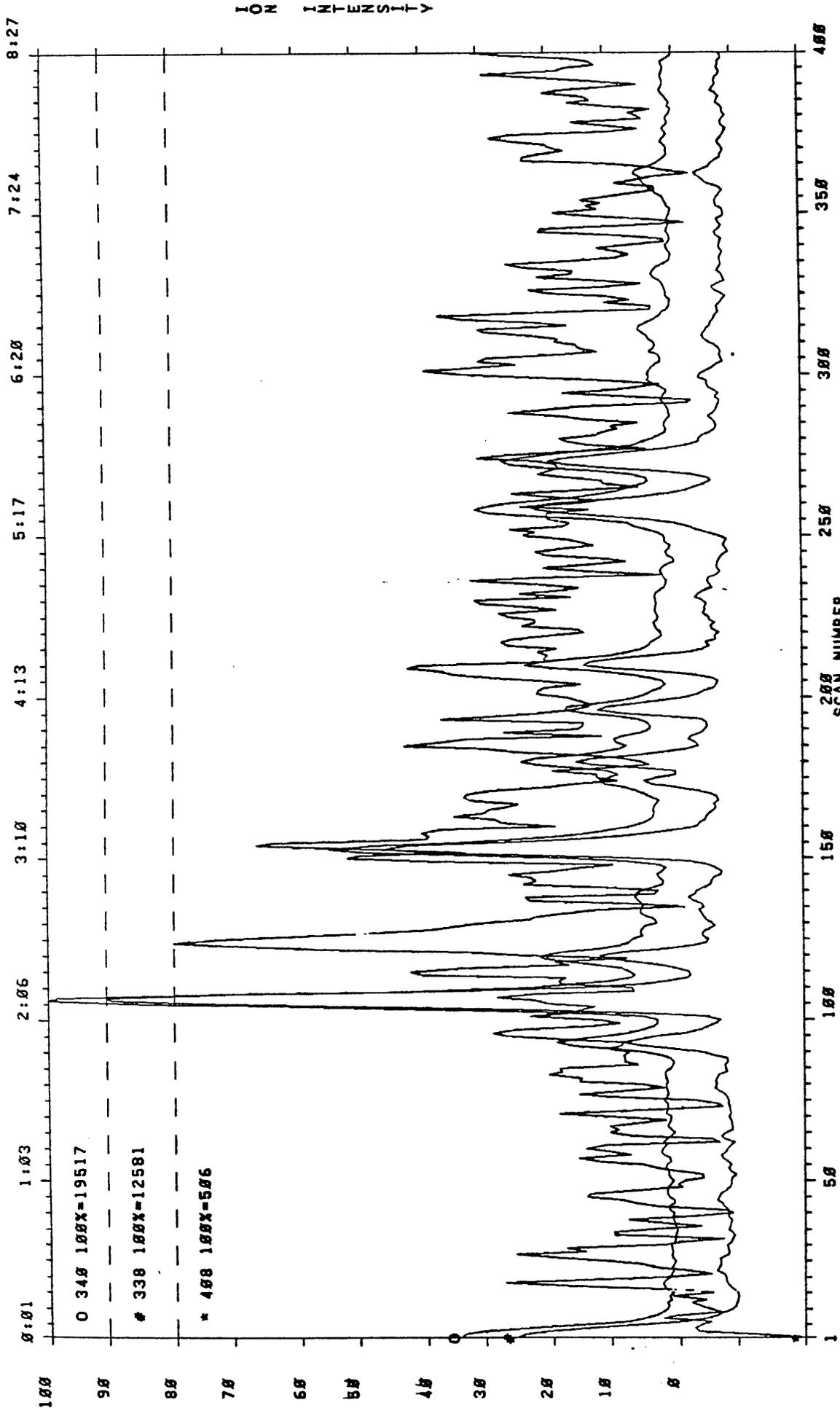
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D2 M5 F
FIGURE: 274

DATE: 02/02/84 TIME: 13:20
KRATOS MS25, DS55 SOFTWARE, RUN: TOR40076, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



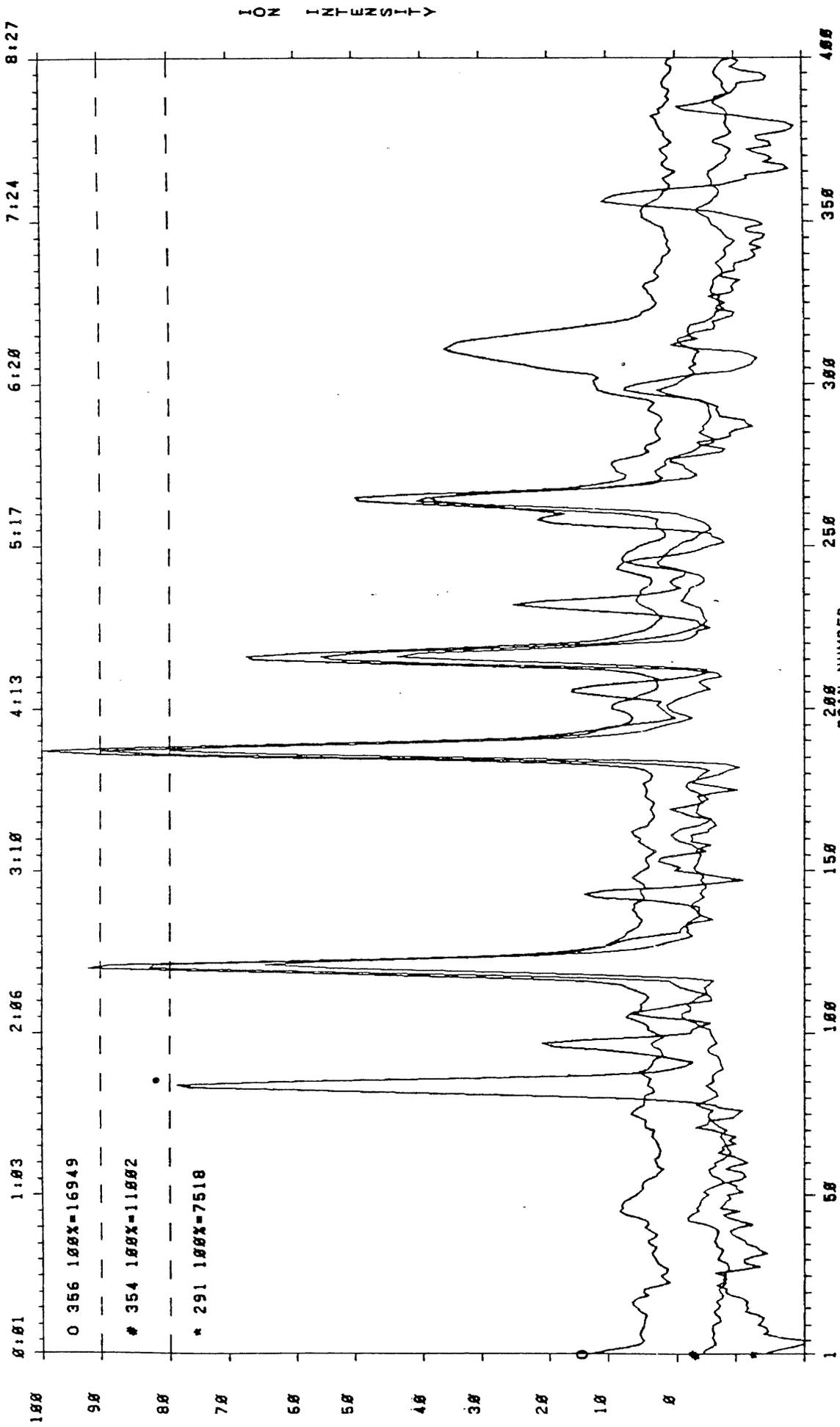
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2D2 M5 F
FIGURE: 275

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03-02/ TIME: 13:29
KRATON MS25, DS55 SOFTWARE, RUN: JOR50064, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



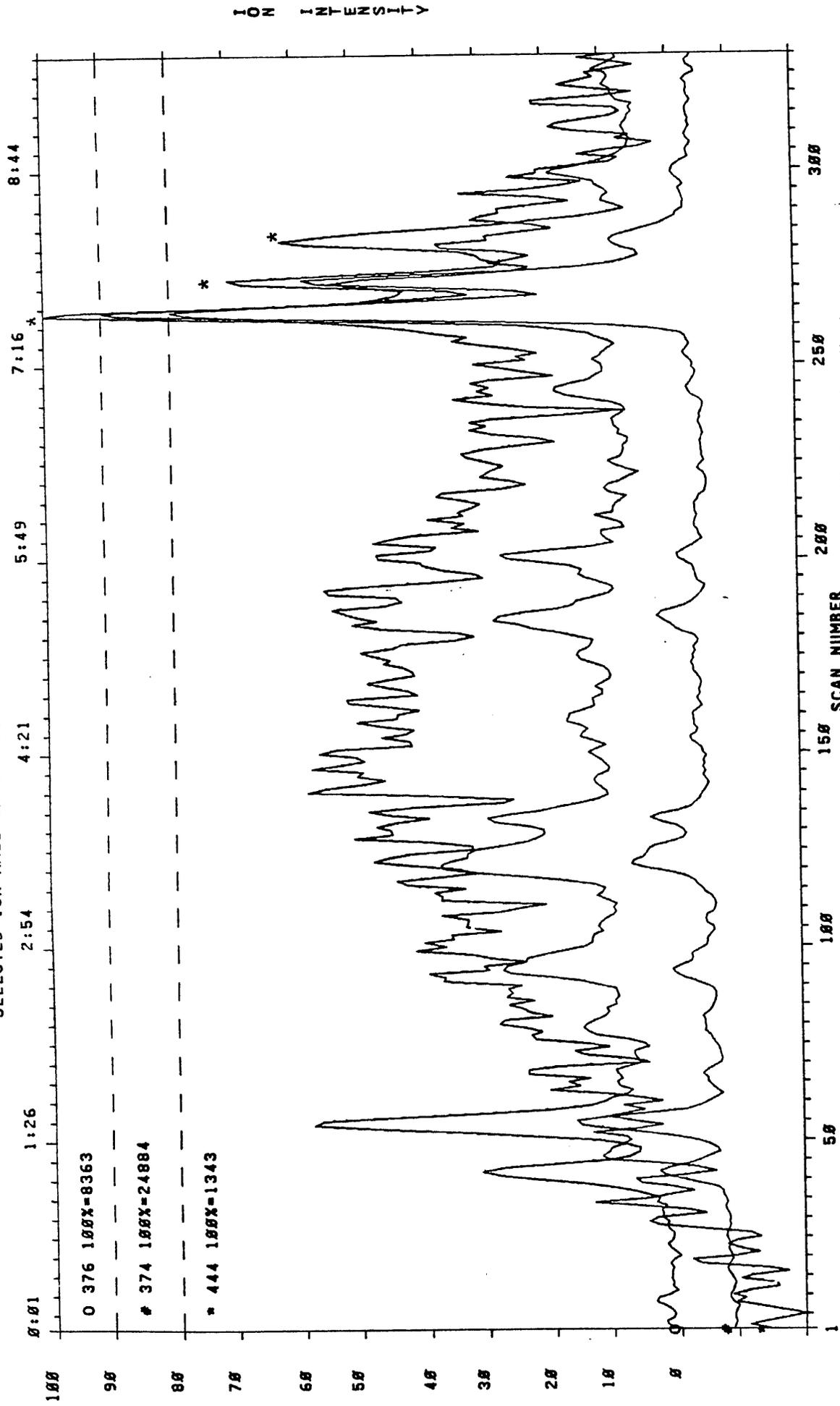
HRGC-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE No.262 H5 F
FIGURE: 276

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 13:29
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50064, WSU NAME: CHJ-48.75
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202 M5 F
FIGURE: 277

GREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02 TIME: 13:39
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60065, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS

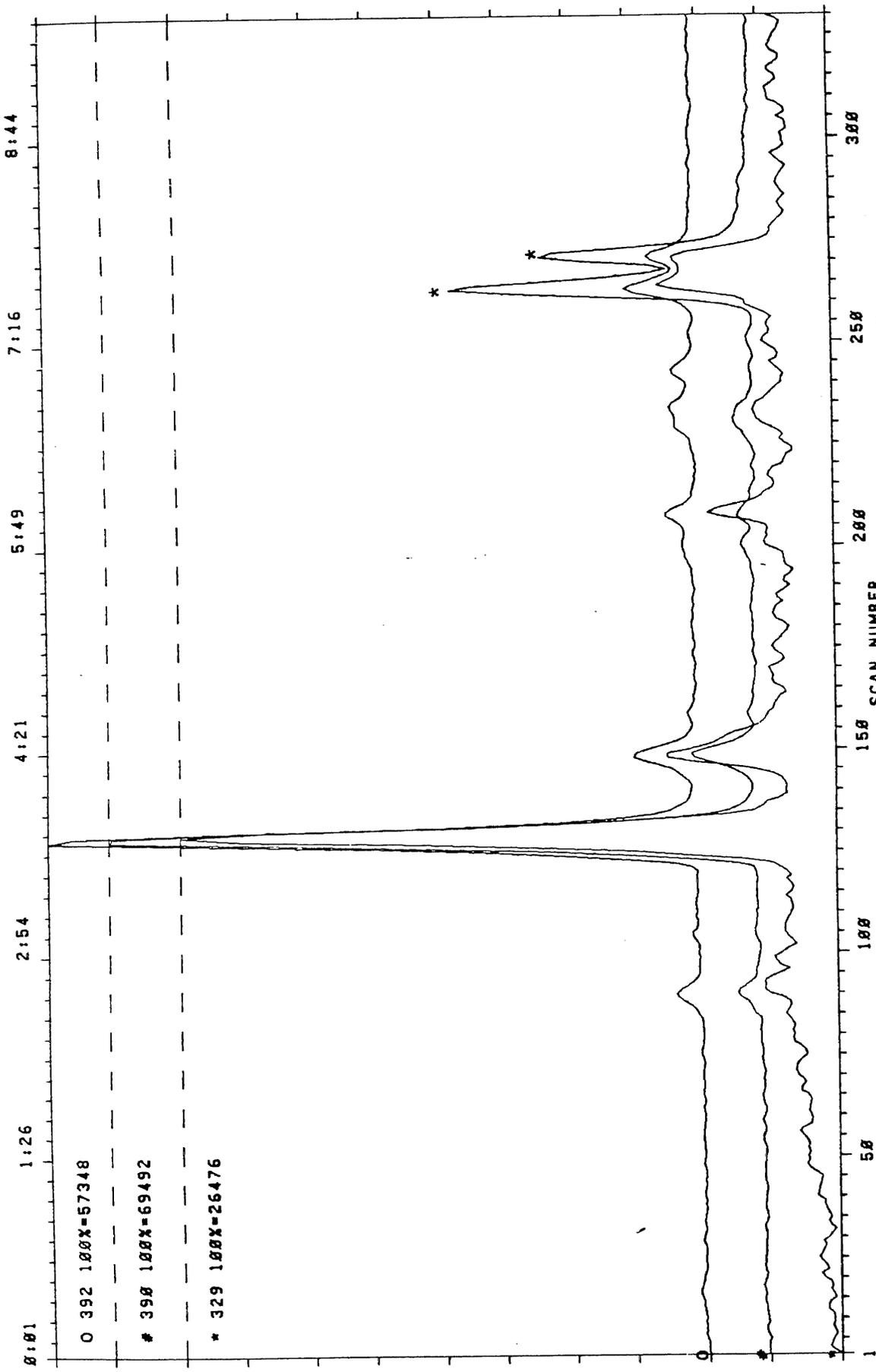


0 376 100X=8363
374 100X=24884
* 444 100X=1343

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO. 202 H5 F
FIGURE: 278

DATE: 03/02/84 TIME: 13:39
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60065, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS

ION INTENSITY

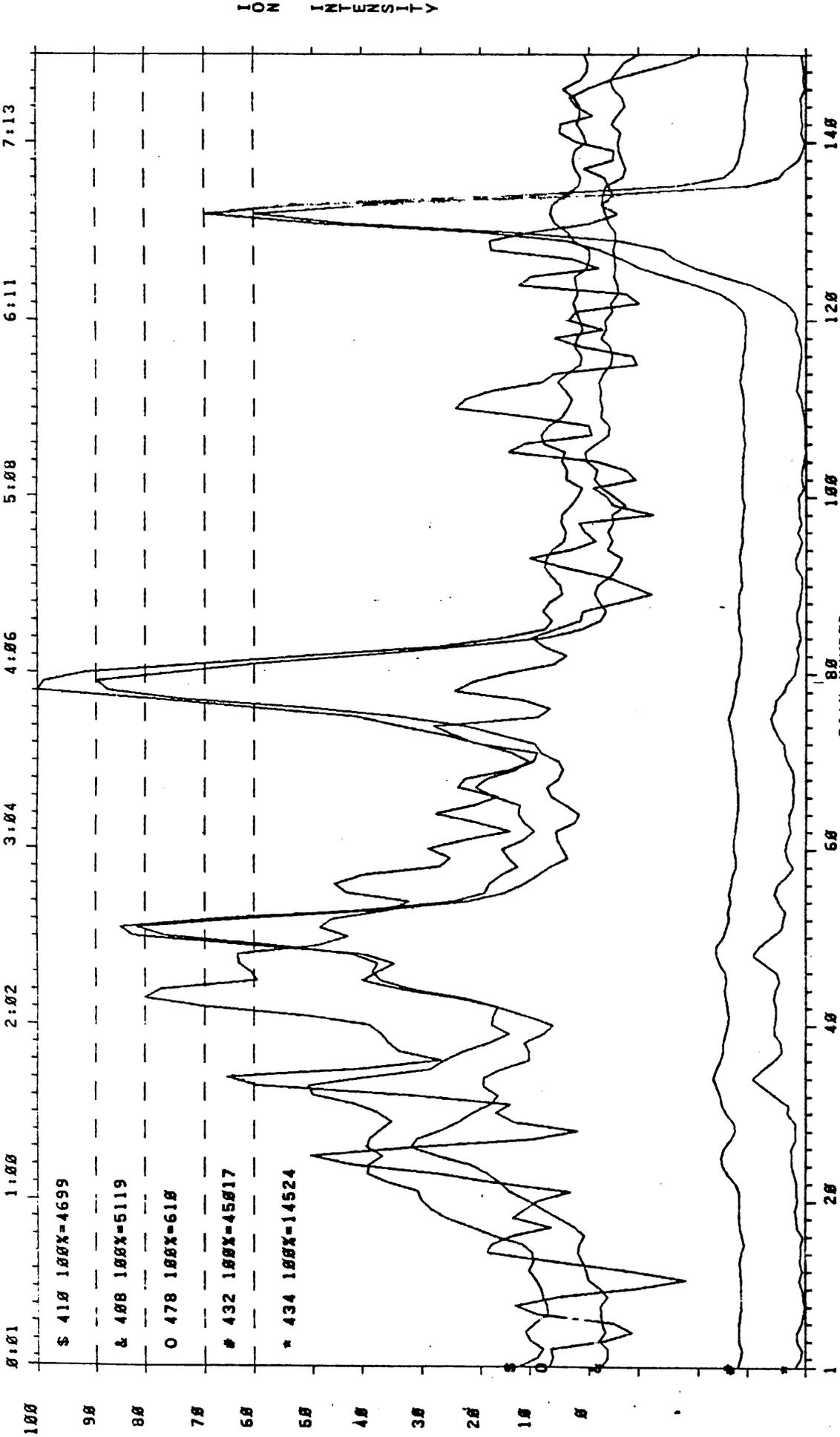


HPLC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 252 H6 F
FIGURE: 279

BE-LIM LABORATORY 7 - WRIGHT STATE UNIVERSITY DAYTON, OHIO 45435

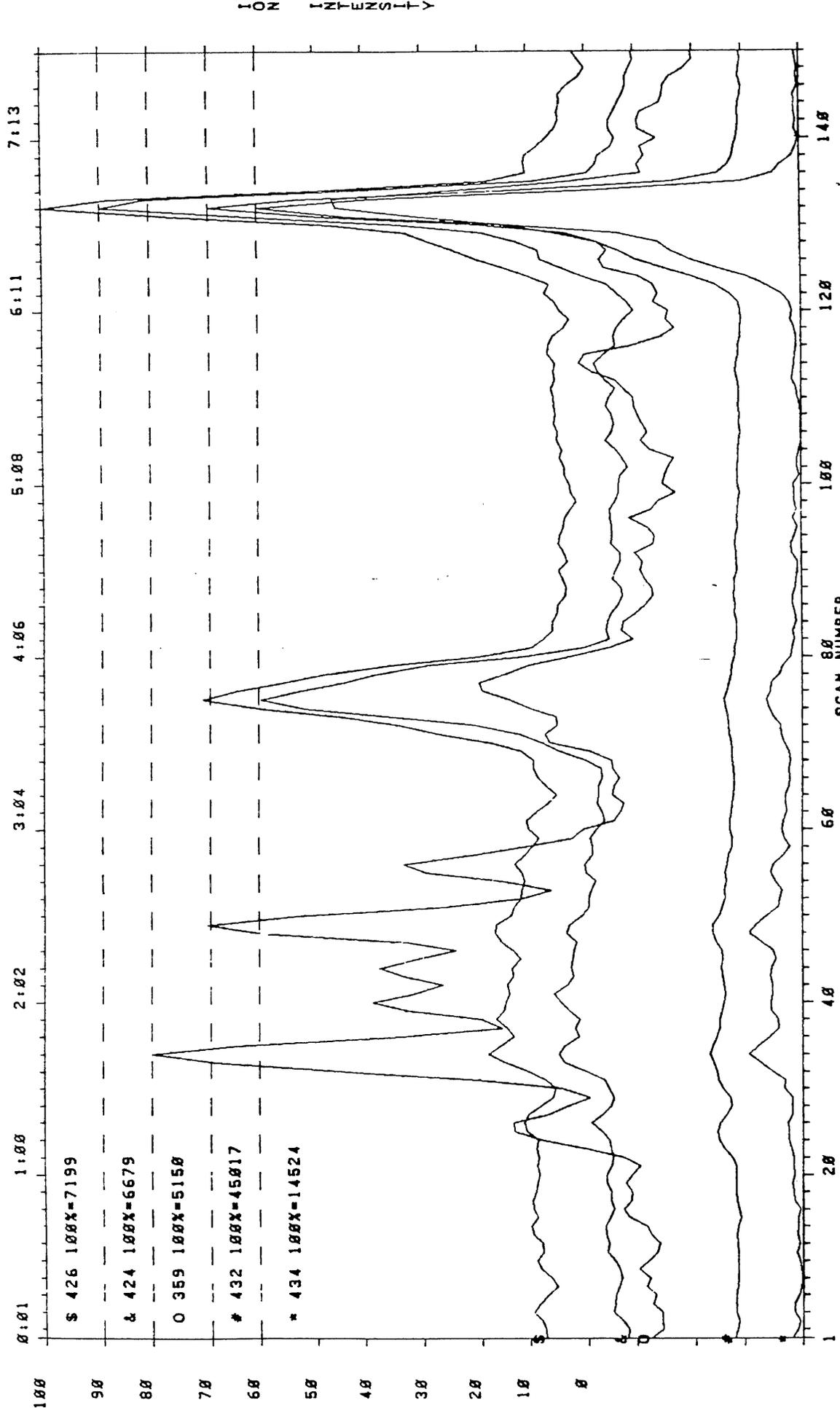
DATE: 03/02/77 TIME: 15:47

KRATOS MS25, DSS5 SOFTWARE, RUN: TOR70066, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



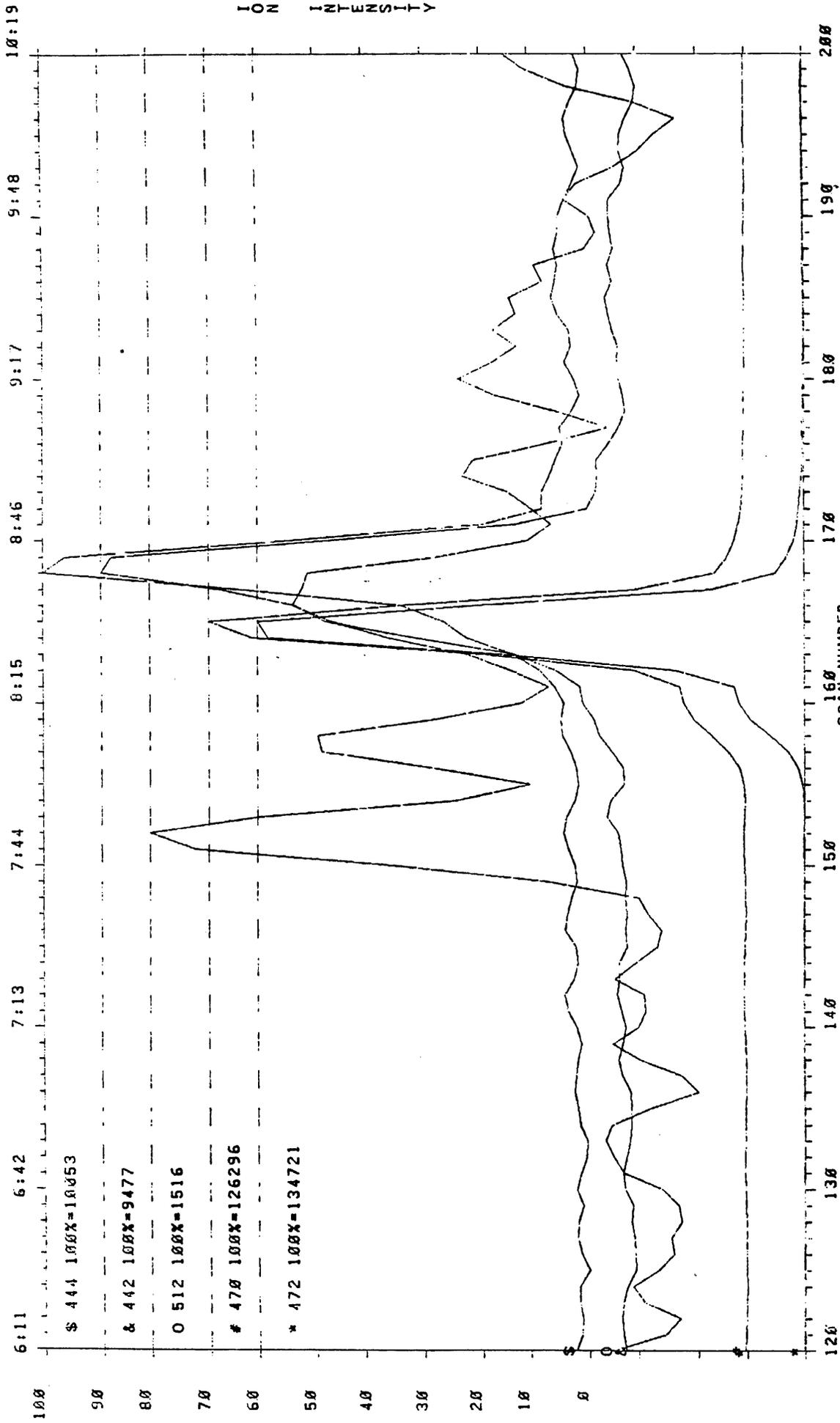
HRGC-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 202 H5 F
SCAN NUMBER
FIGURE: 280

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 13:47
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR70066, WSU NAME: CHJ-48.75
 SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



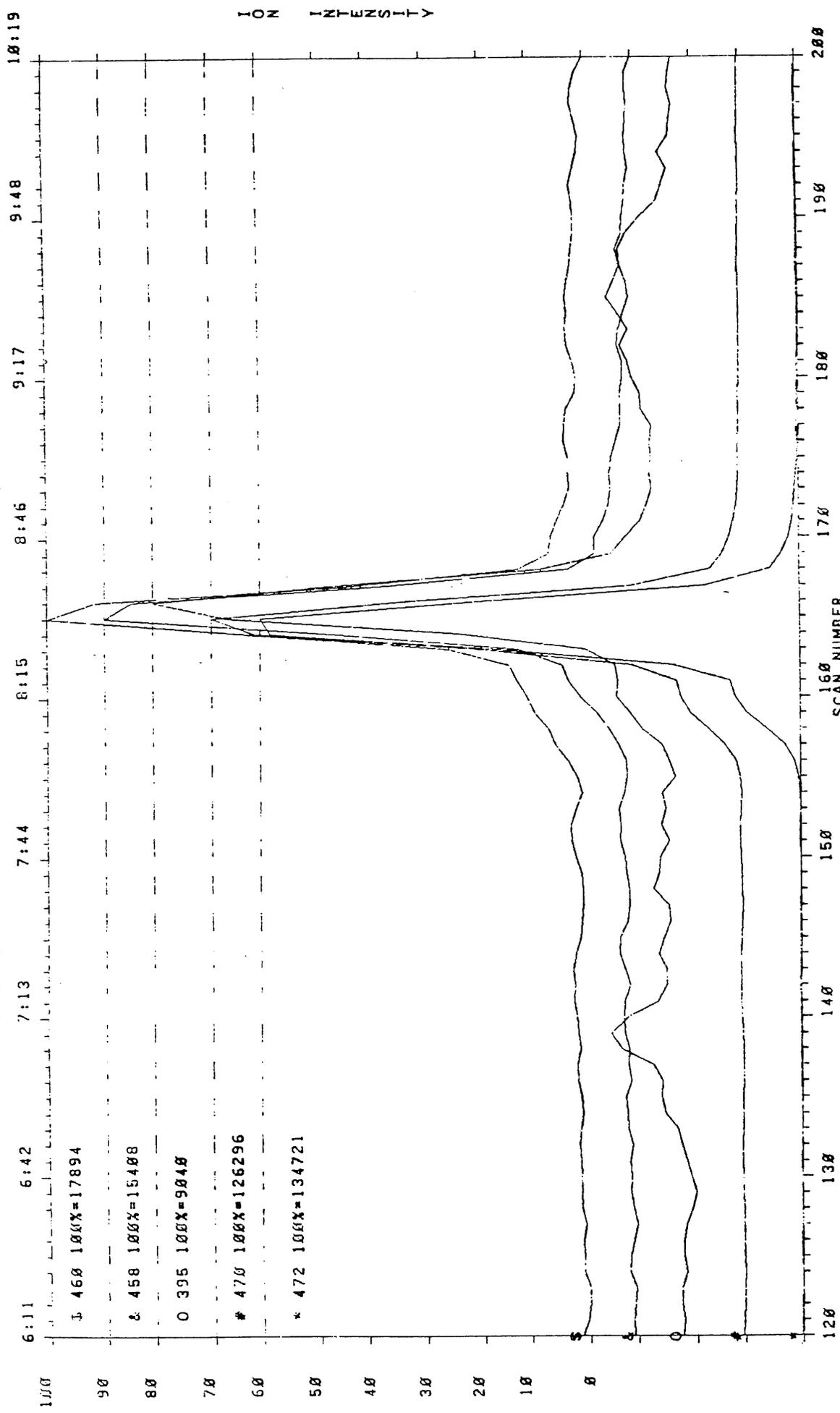
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.202 M5 F
 FIGURE: 281

P ERM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 14:03
KRATOS MS25, DS55 SOFTWARE, RUN: 10R00072, WSU NAME: CHJ-48,75
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFRANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2D2 M5 F
FIGURE: 282

DATE: 03/02/84 TIME: 14:03
KRATOS MS25, DS55 SOFTWARE, RUN: TOR80072, WSU NAME: CHJ-48.75
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS

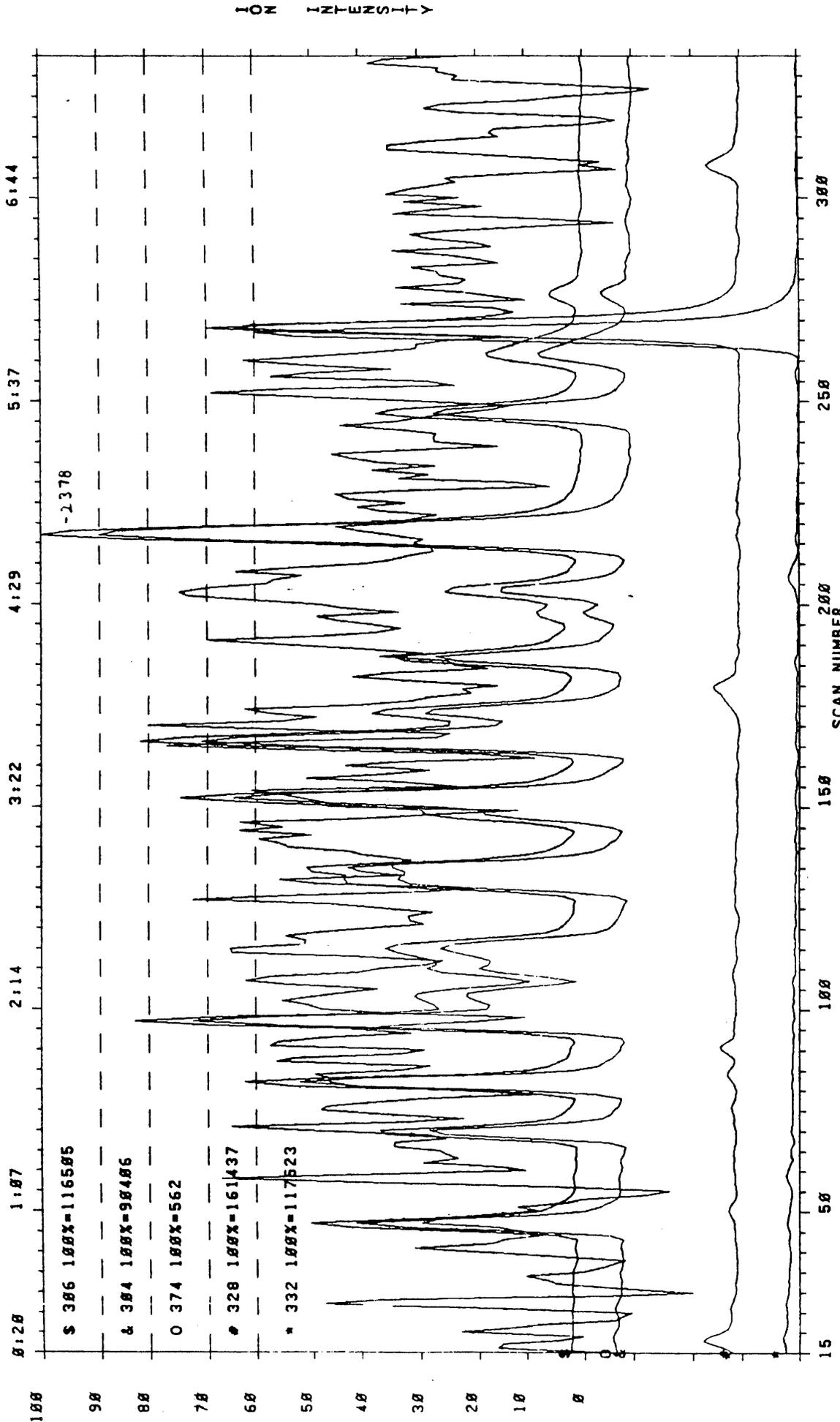


HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.202 M5 F
SCAN NUMBER
FIGURE: 283

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

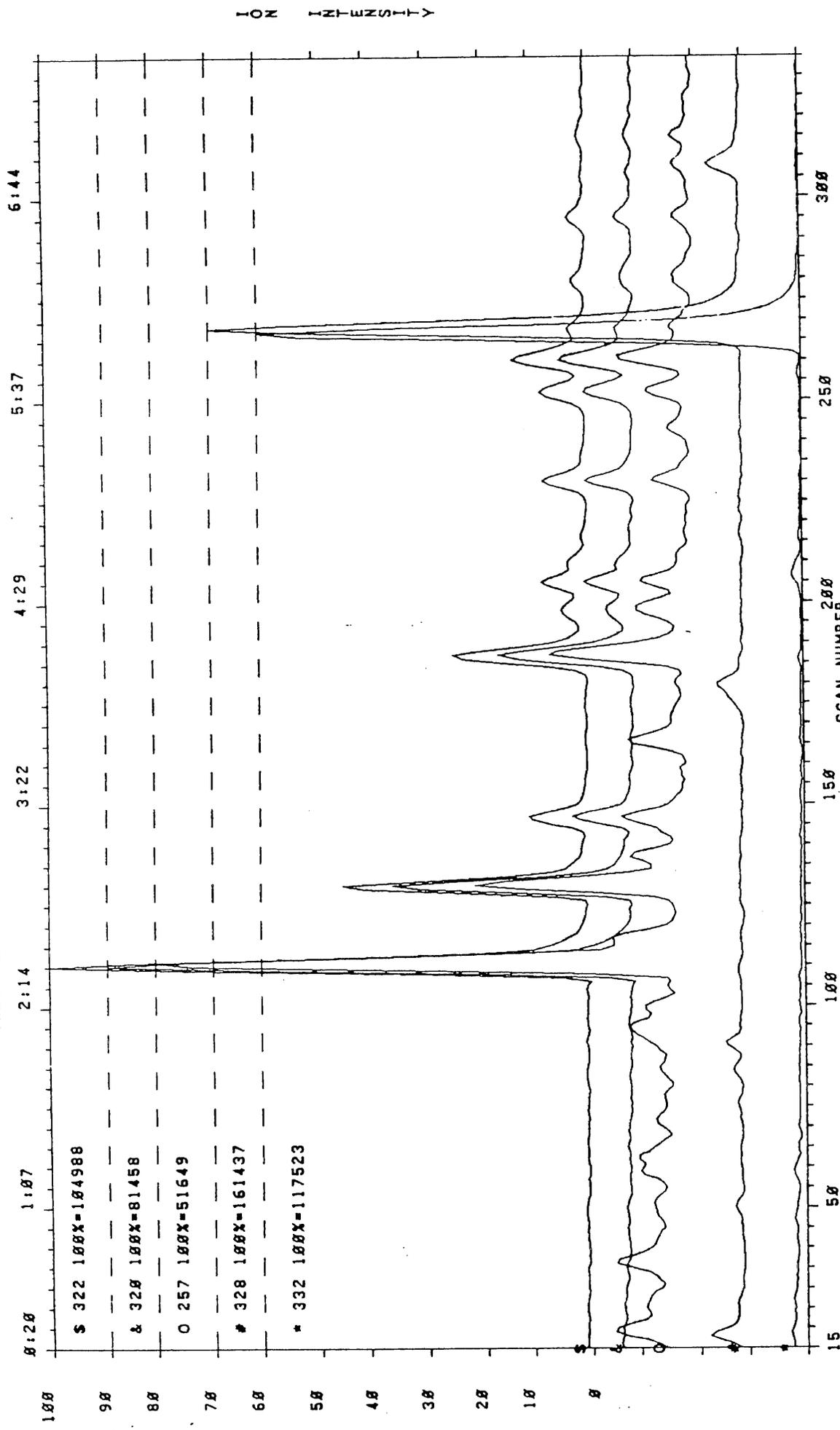
DATE: 03/02/84 TIME: 10:51

KRATOS MS25, DS55 SOFTWARE, RUN: TOR40074, WSU NAME: CJ-68
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1 17 F
SCAN NUMBER 200
FIGURE: 433

WRIGHT LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 10:51
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR40074, WSU NAME: CHJ-68
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



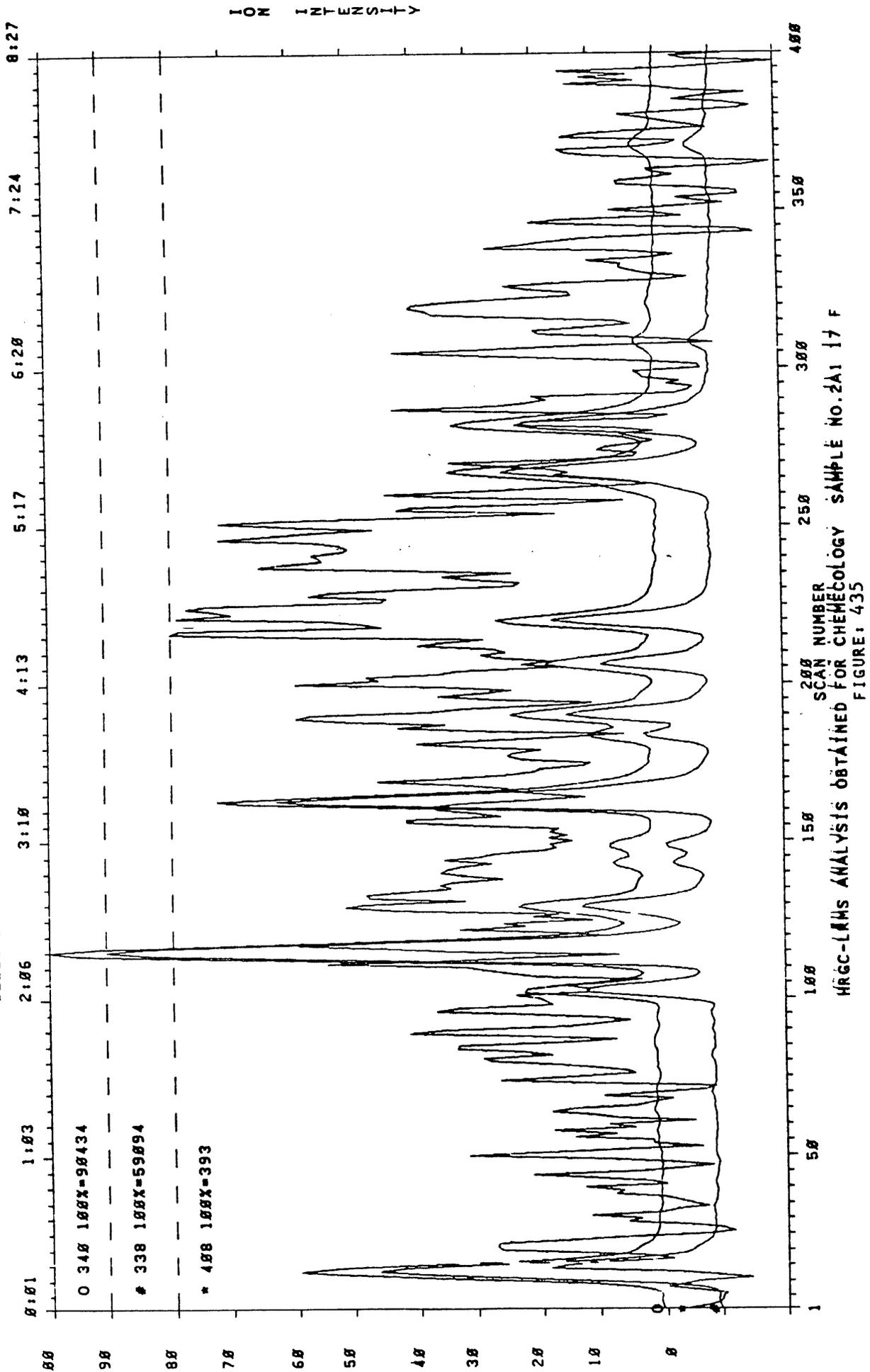
100
 90
 80
 70
 60
 50
 40
 30
 20
 10
 0

\$ 322 100% = 104988
 & 328 100% = 81458
 O 257 100% = 51649
 # 328 100% = 161437
 * 332 100% = 117523

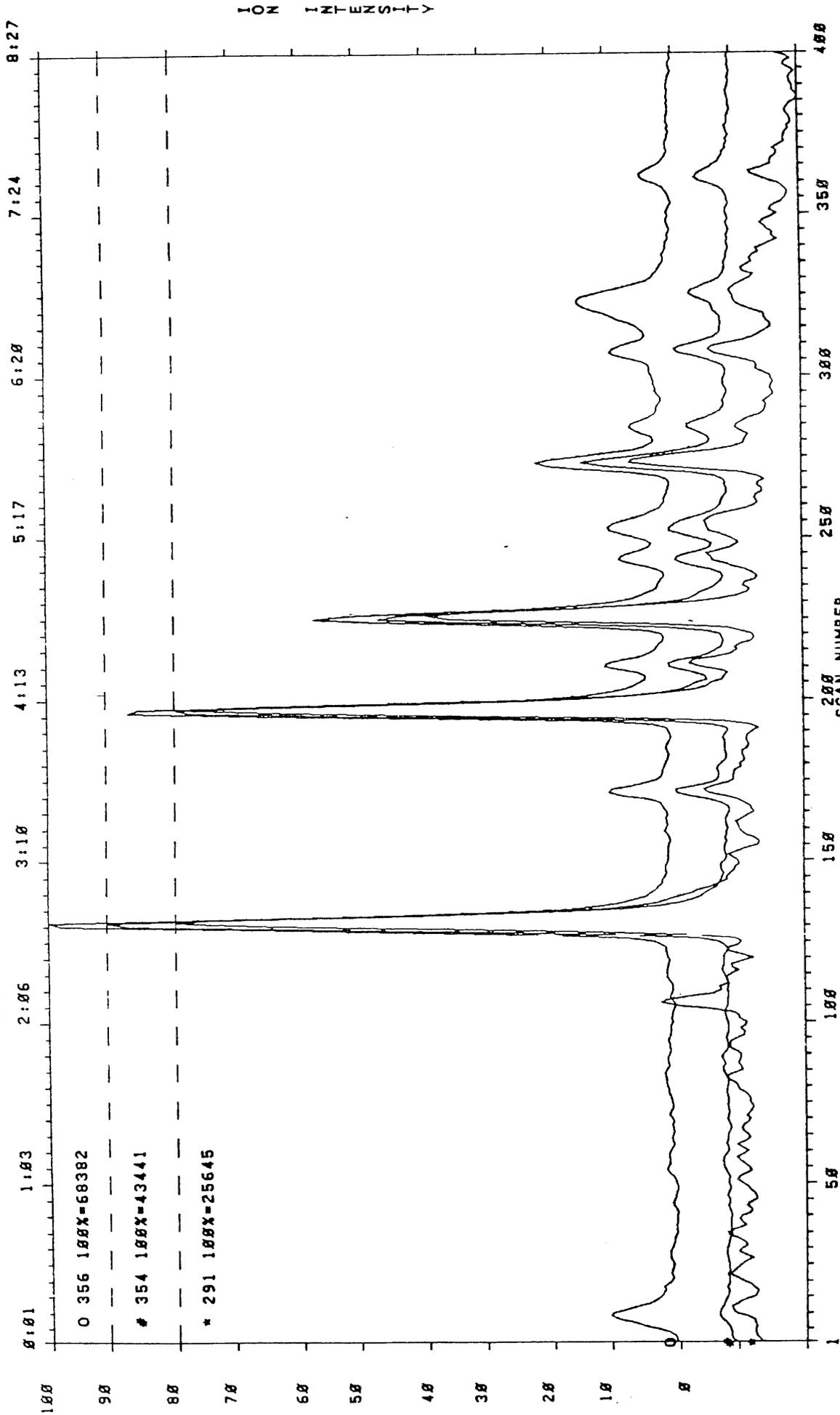
15 50 100 150 200 250 300
 SCAN NUMBER

HPLC-MS ANALYSIS OBTAINED FOR CHEHEC6166V SAMPLE NO. 2A1 17 F
 FIGURE: 434

BKHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 11:00
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50062, WSU NAME: CHJ-68
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



CRETE LABORATORY - NIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 11:00
KRATOS MS25, DS55 SOFTWARE, RUN: TOR50062, WSU NAME: CHJ-68
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



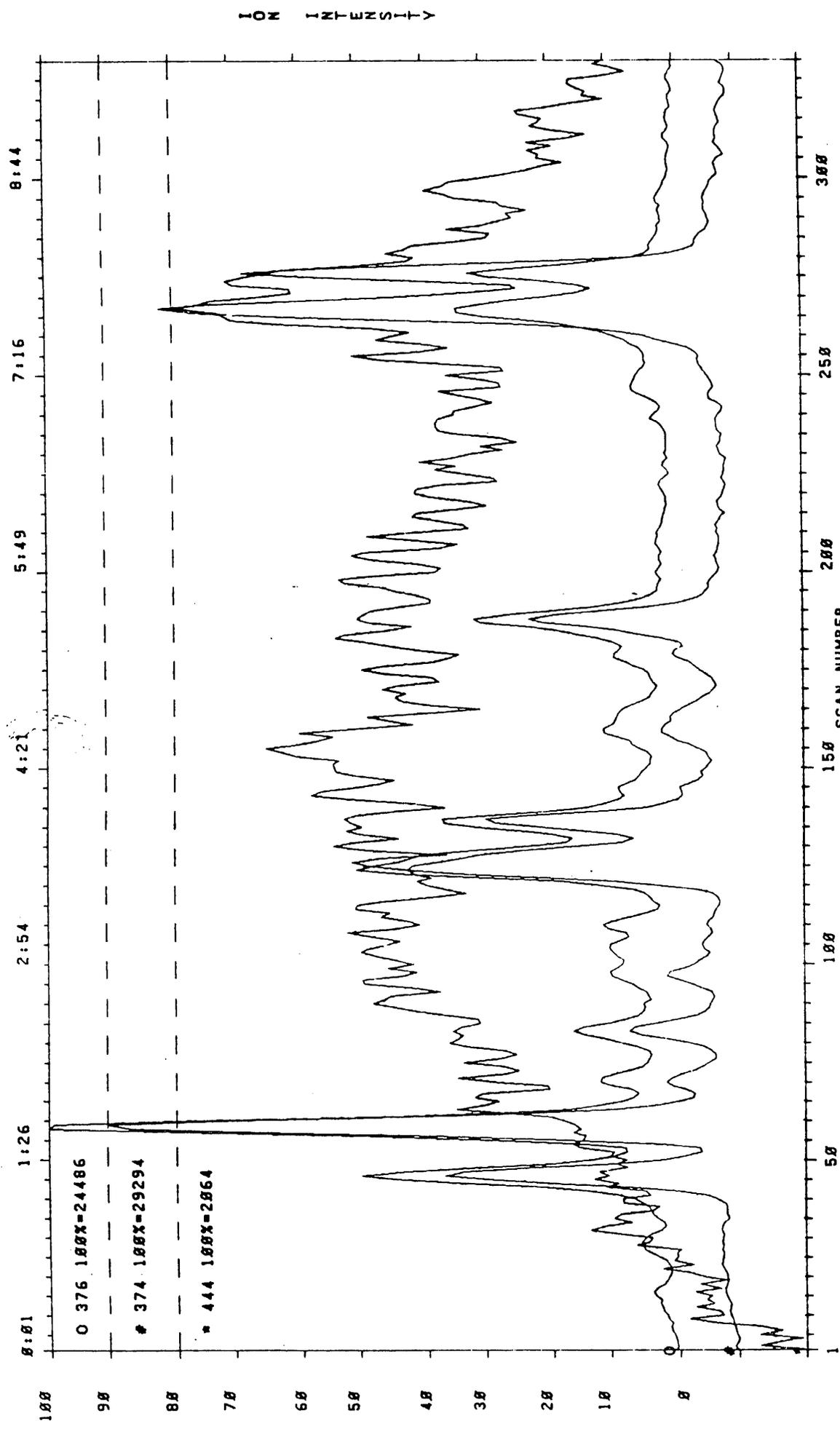
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1 17 F
FIGURE: 436

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 03/02/84 TIME: 11:10

KRATOS MS25, DS55 SOFTWARE, RUN: TOR60063, WSU NAME: CHJ-68

SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



300

250

200

150

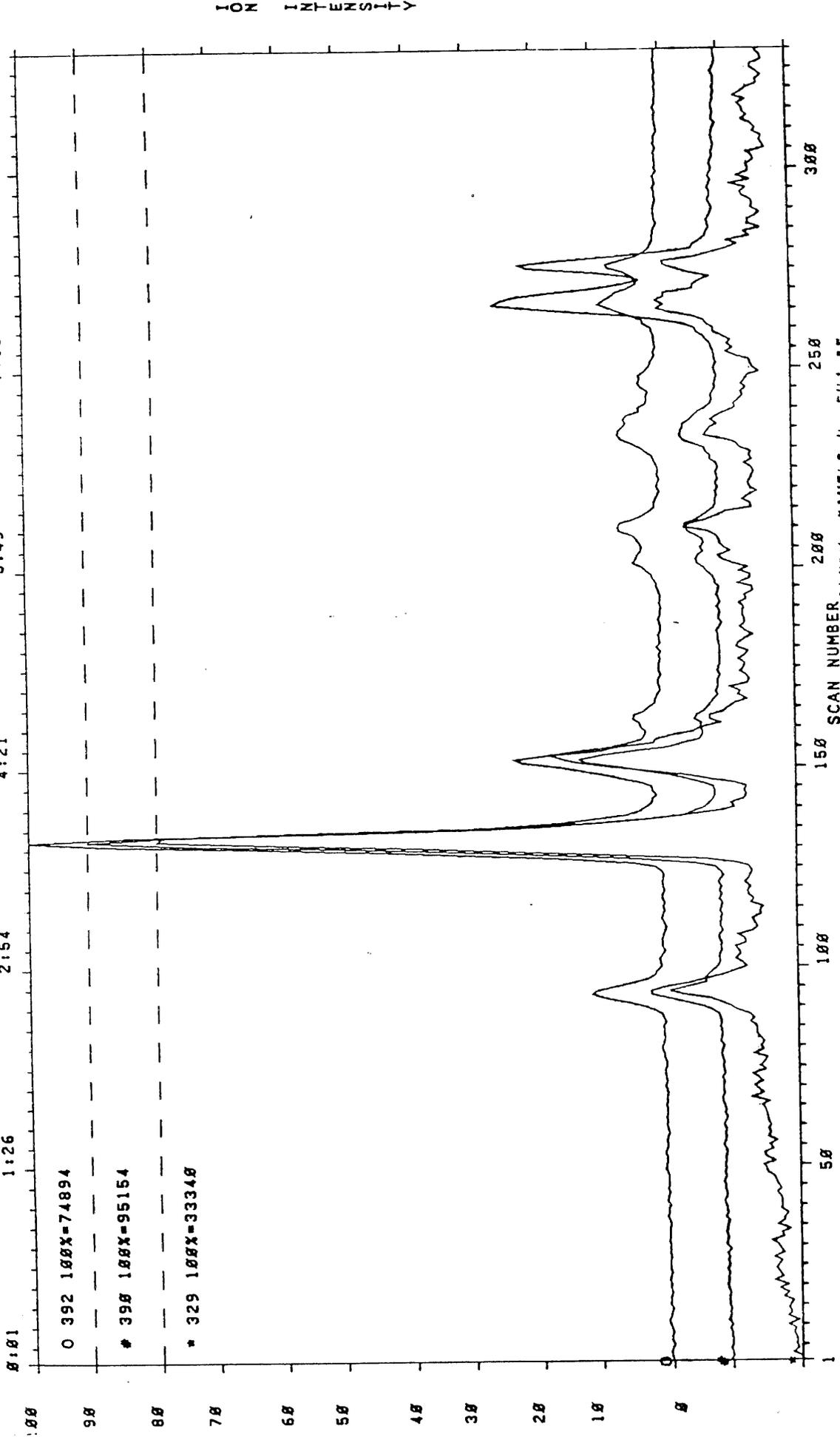
100

50

1

HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A1 17 F
FIGURE: 437

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 11:10
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60063, WSU NAME: 5
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS

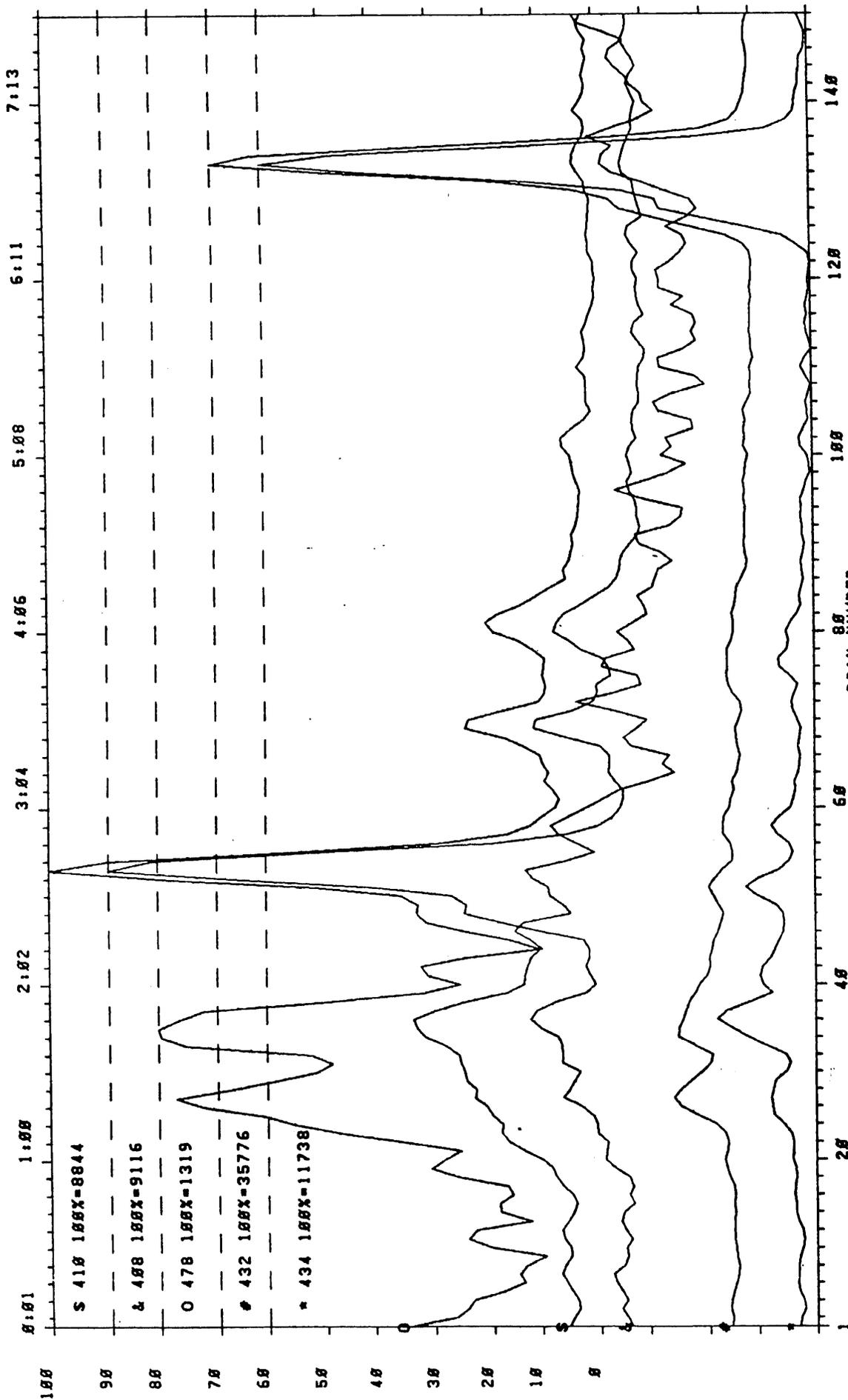


HEX-CLAMS ANALYSIS OBTAINED FOR CHEMECOLOGY. SAMPLE No. CHJ-88
FIGURE: 438

BRKHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 03/02/84 TIME: 11:18

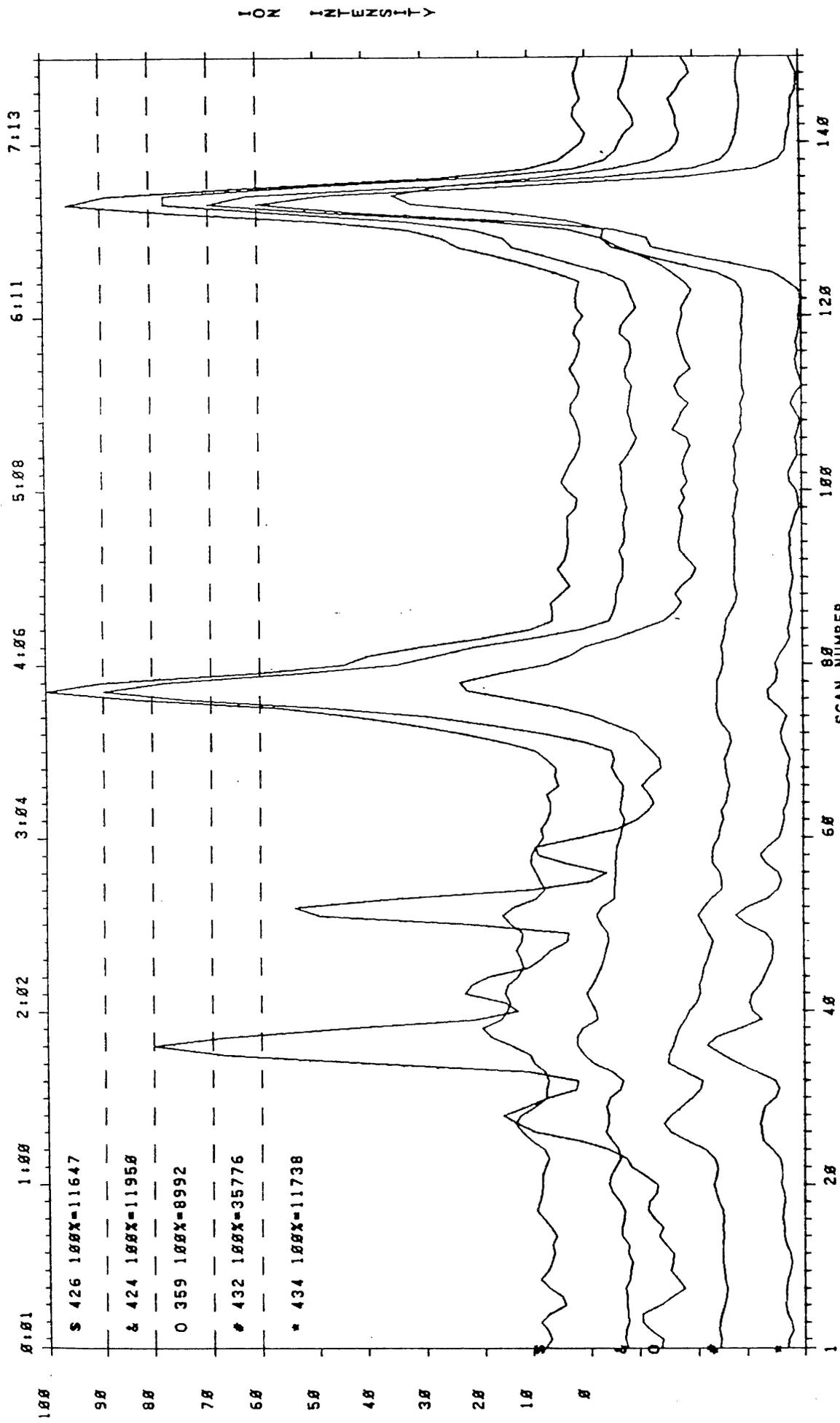
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70064, WSU NAME: CHJ-68
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



S 418 100X=8844
& 488 100X=9116
O 478 100X=1319
432 100X=35776
* 434 100X=11738

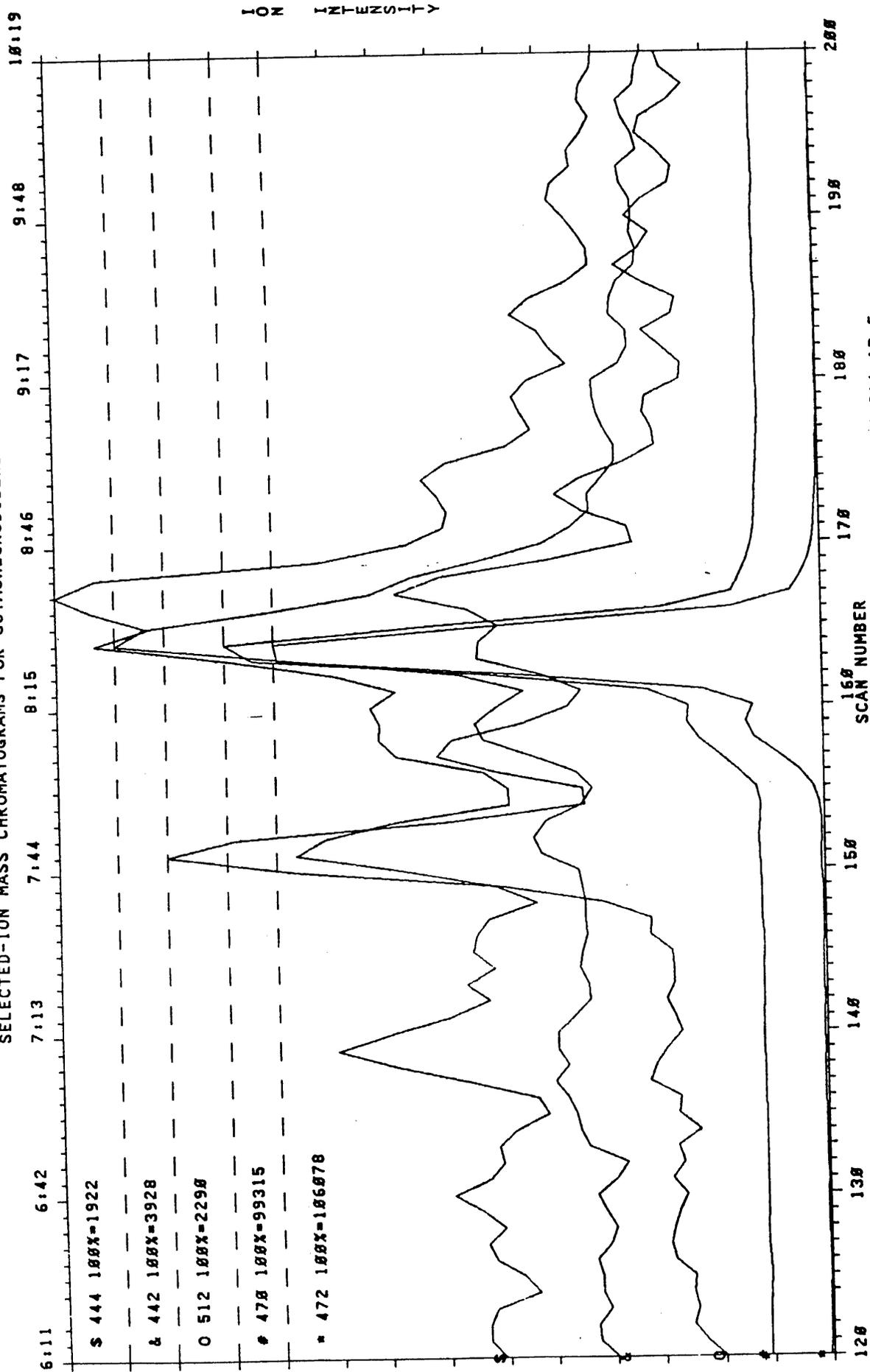
SCAN NUMBER
SAMPLE No. 2A1 17 F
FIGURE: 439

BREH: LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 11:18
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR70064, WSU NAME: CHJ-68
 SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



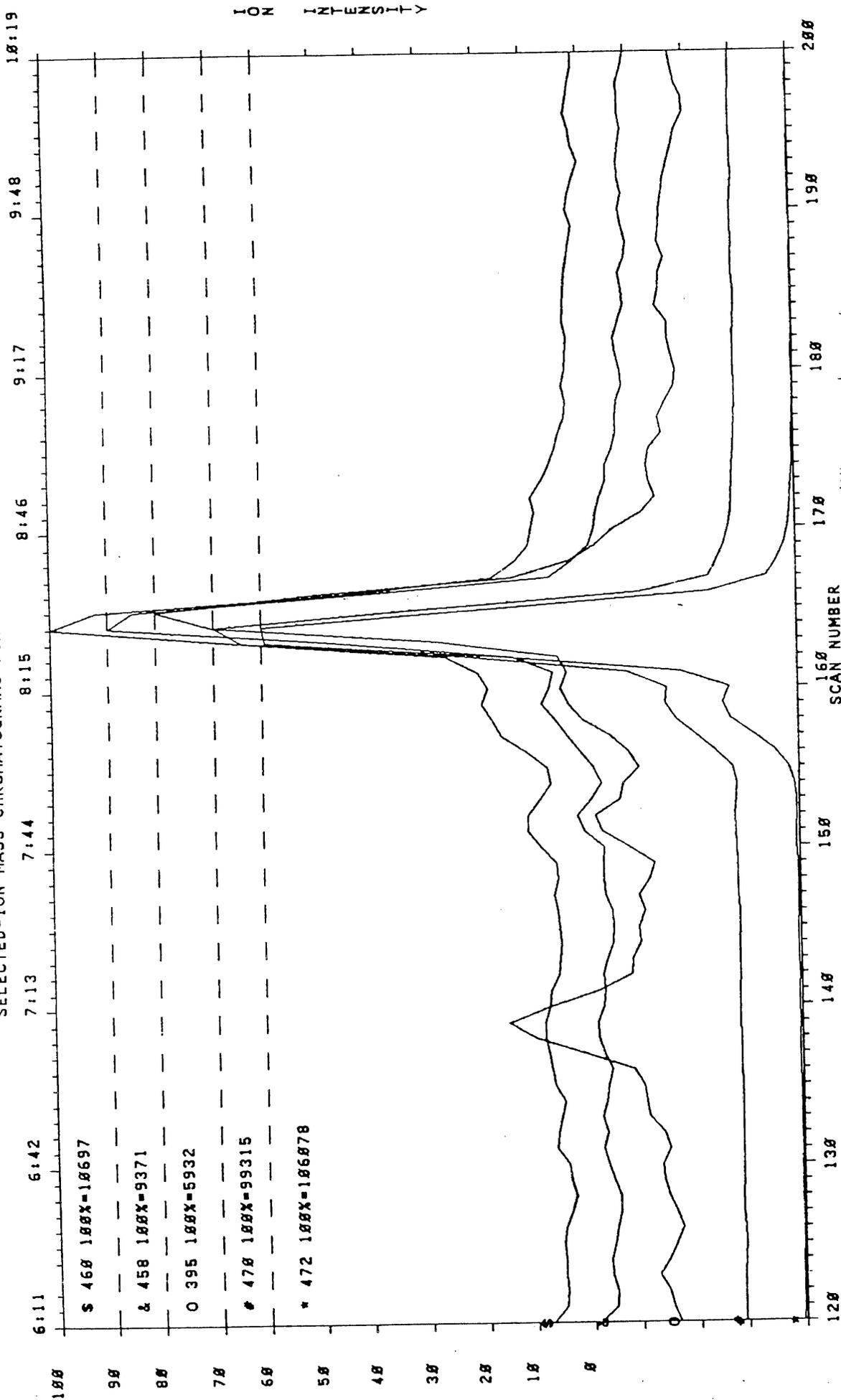
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A1 17 F
 FIGURE: 440

BREHN LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 11:33
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR80069, WSU NAME: CHJ-68
 SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS



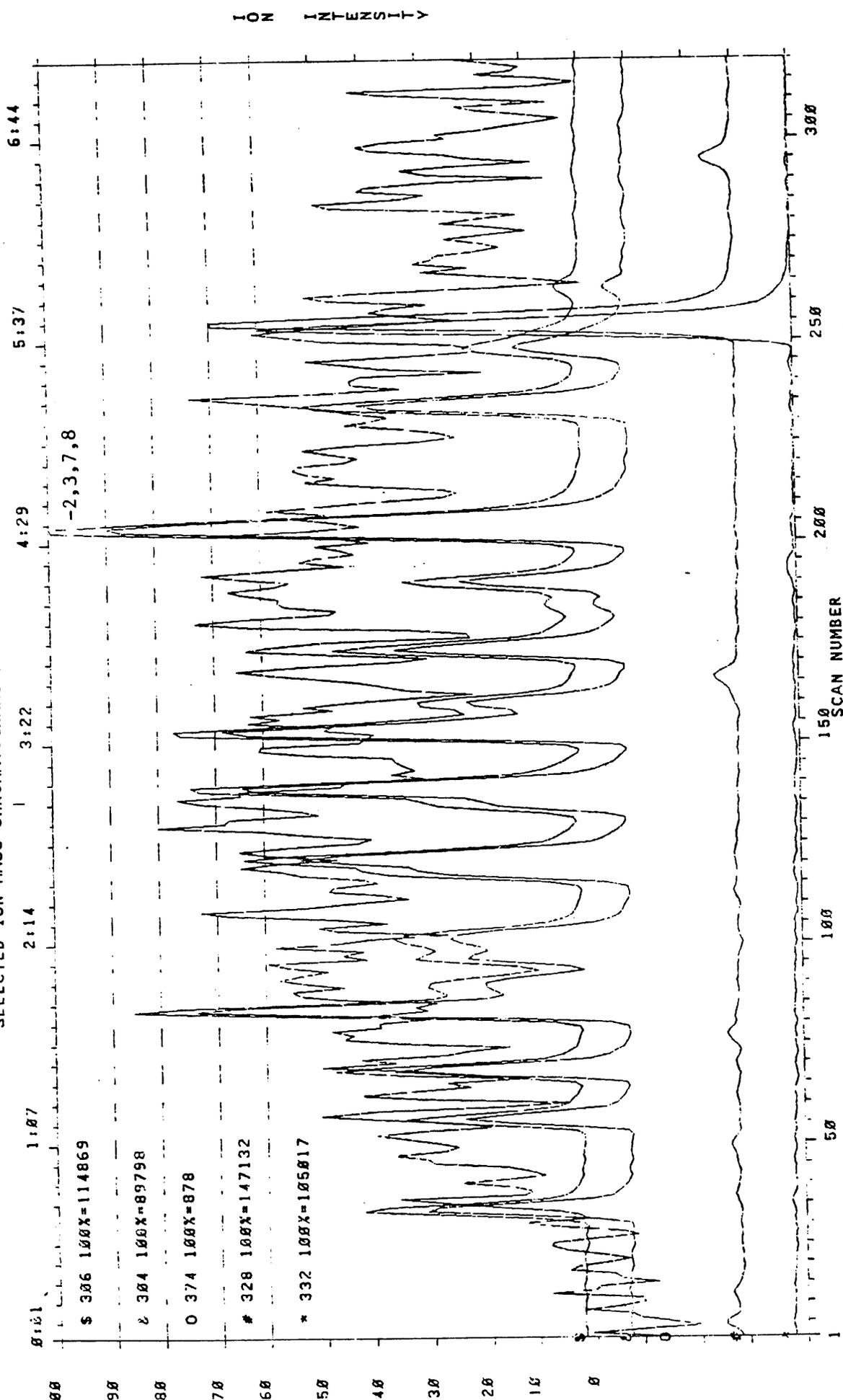
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A1 17 F
 FIGURE: 441

BIOMEDICAL LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 11:33
KRATOS MS25, DS55 SOFTWARE, RUN: TOR80069, WSU NAME: CHJ-68
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



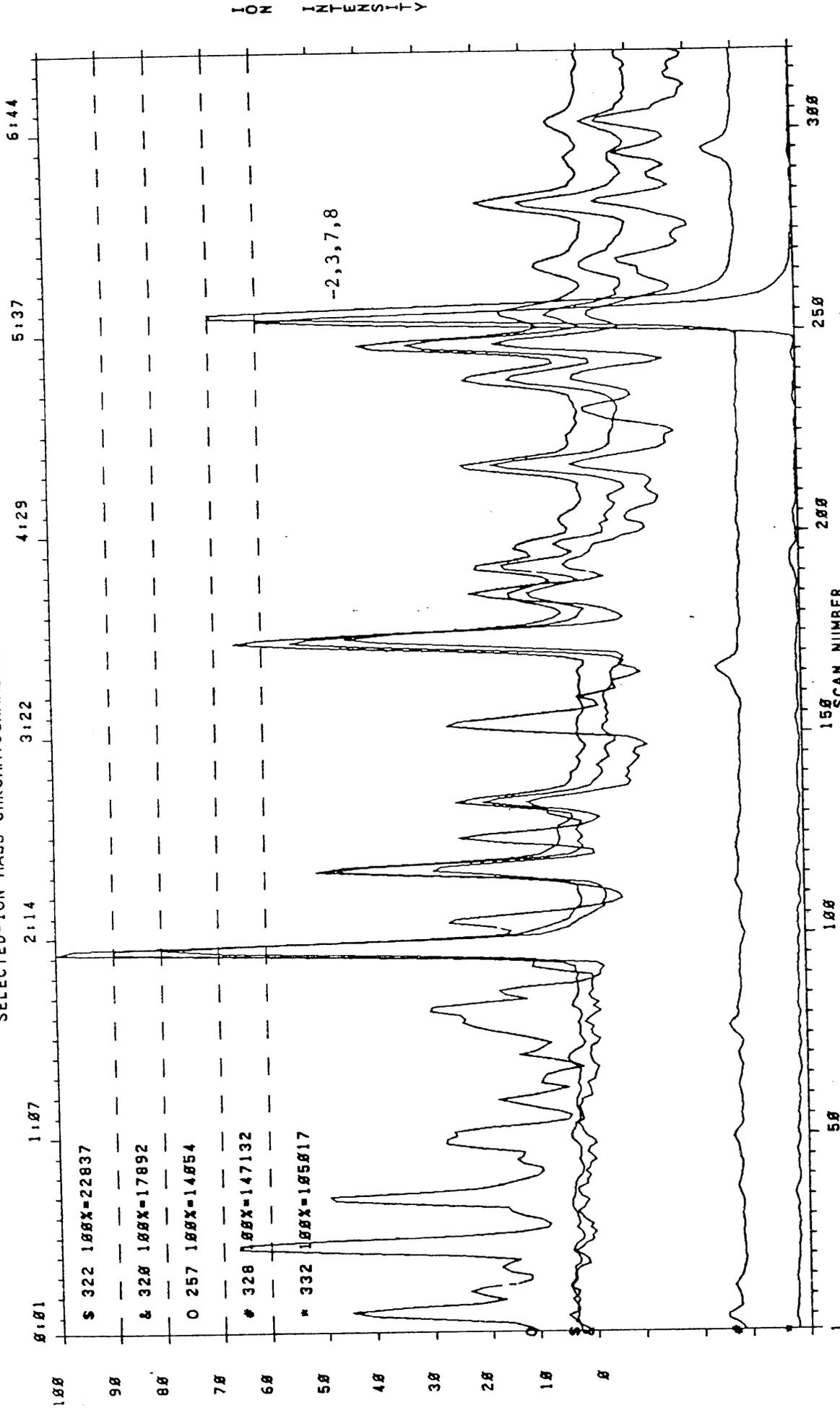
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A1 17 F
FIGURE: 442

WRENN LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:08
KRATOS MS25, DS55 SOFTWARE, RUN: TOR40075, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZOFURANS



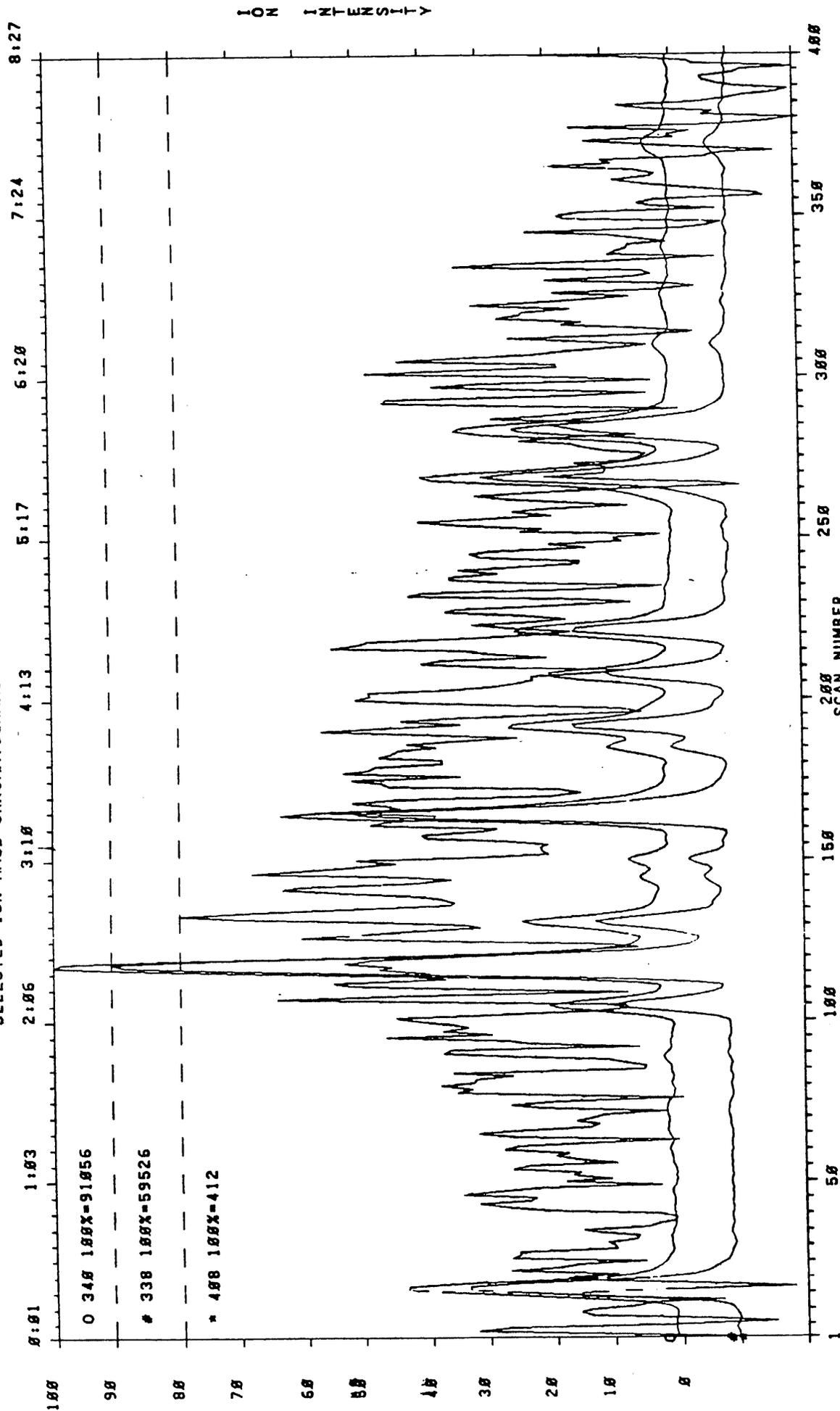
150 SCAN NUMBER
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO. 2A2 17 F
FIGURE: 443

BREH: LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 12:08
 KRATOS MS25, DS55 SOFTWARE, RUN: TOR40075, WSU NAME: CHJ-69
 SELECTED-ION MASS CHROMATOGRAMS FOR TETRACHLORODIBENZO-P-DIOXINS



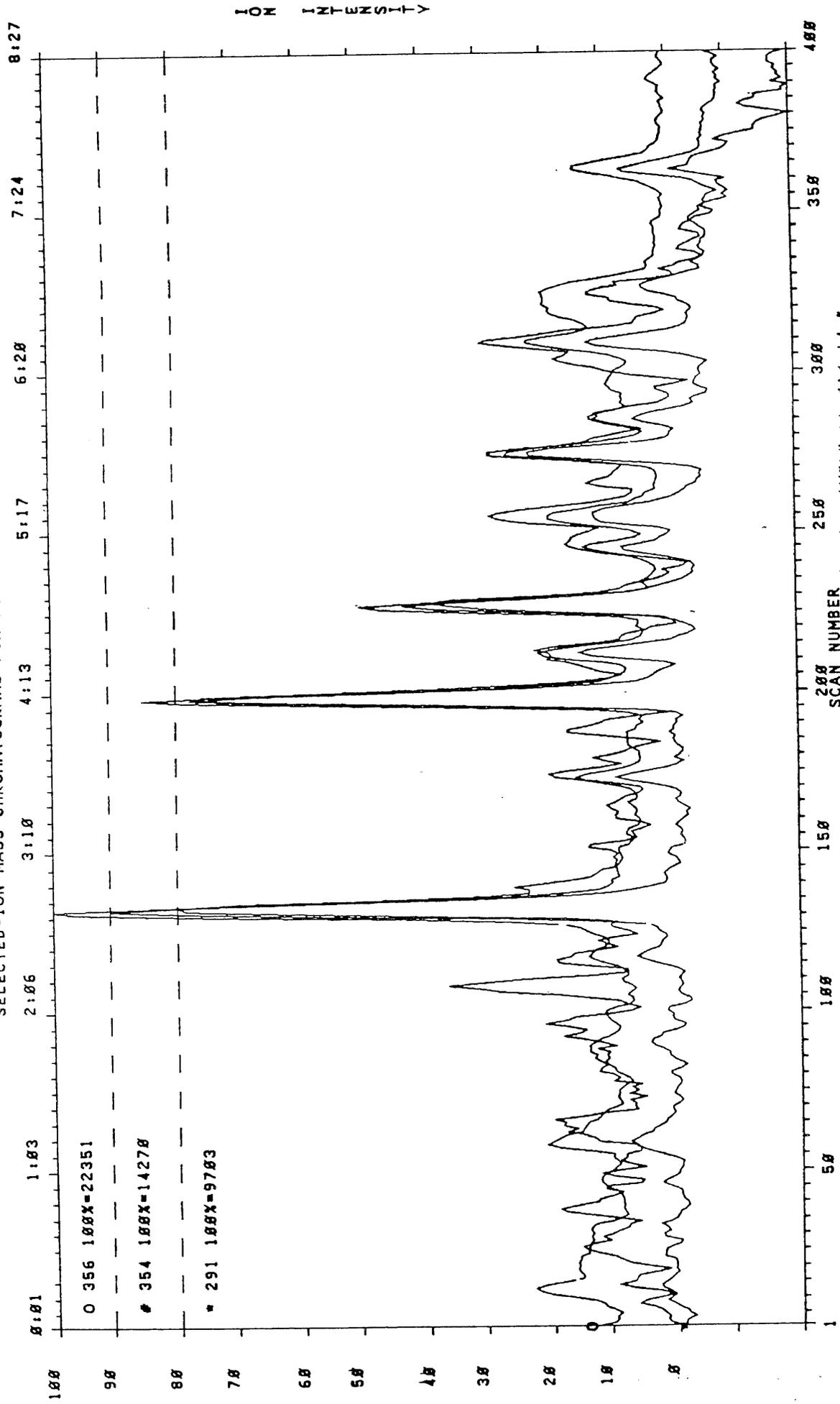
100 90 80 70 60 50 40 30 20 10 0
 S 322 100% = 22837
 Q 320 100% = 17892
 O 257 100% = 14054
 P 328 100% = 147132
 R 332 100% = 105617
 -2,3,7,8
 1:07 2:14 3:22 4:29 5:37 6:44
 50 100 150 200 250 300
 SCAN NUMBER
 HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 2A2 17 F
 FIGURE: 444

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:17
KRATOS MS25, DS65 SOFTWARE, RUN: TOR50063, VSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZOFURANS



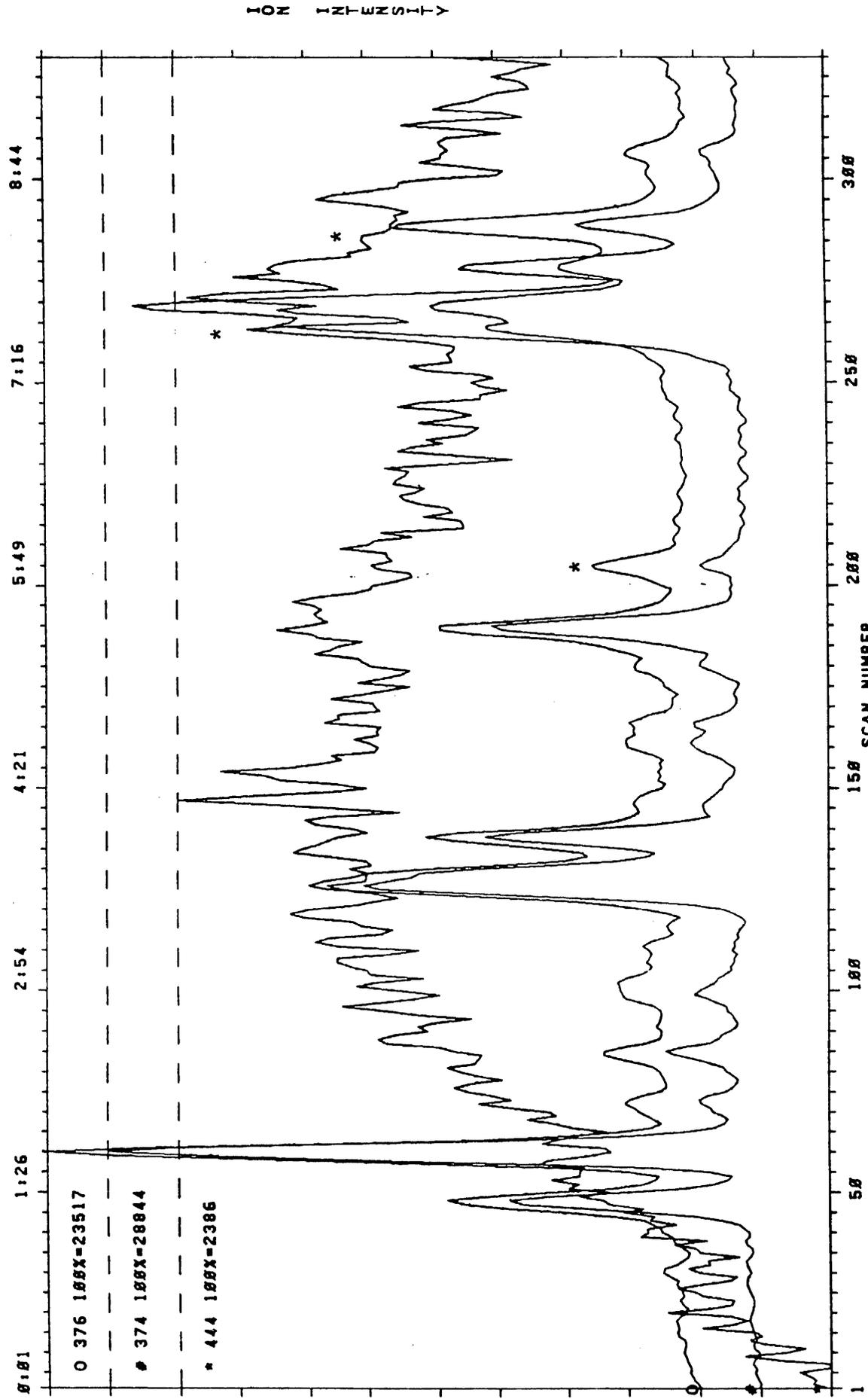
HGCC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 2A2 17 F
SCAN NUMBER 200
FIGURE: 445

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
 DATE: 03/02/84 TIME: 12:17
 KRATOS MS25. DS55 SOFTWARE. RUN: TOR50063, WSU NAME: CHJ-69
 SELECTED-ION MASS CHROMATOGRAMS FOR PENTACHLORODIBENZO-P-DIOXINS



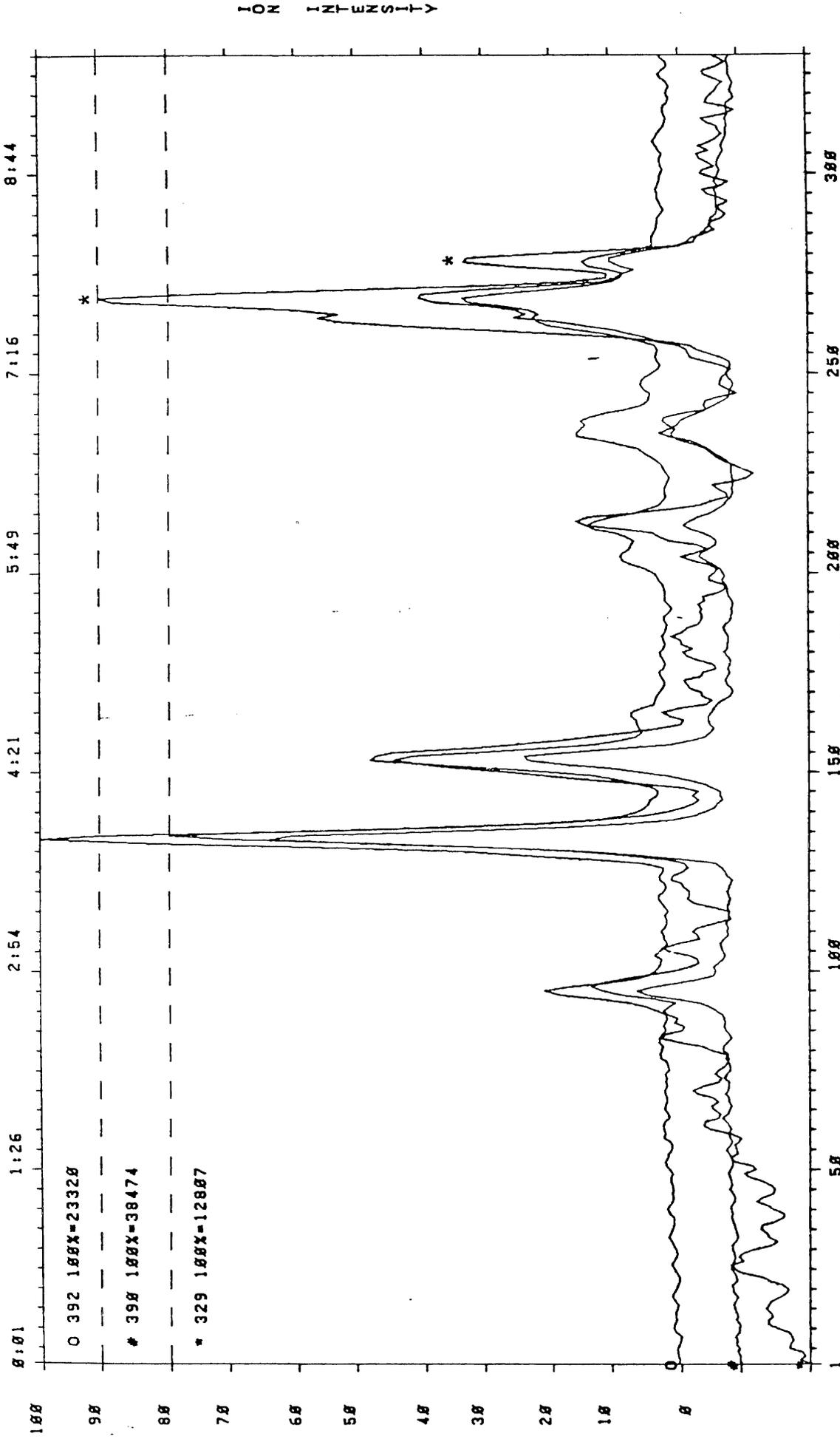
HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2 17 F
 SCAN NUMBER 200
 FIGURE: 446

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:27
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60064, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZOFURANS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A2 17 F
FIGURE: 447

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:27
KRATOS MS25, DS55 SOFTWARE, RUN: TOR60064, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR HEXACHLORODIBENZO-P-DIOXINS



0 392 100% = 23320
* 398 100% = 38474
* 329 100% = 12807

0:01 1:26 2:54 4:21 5:49 7:16 8:44

100 90 80 70 60 50 40 30 20 10 0

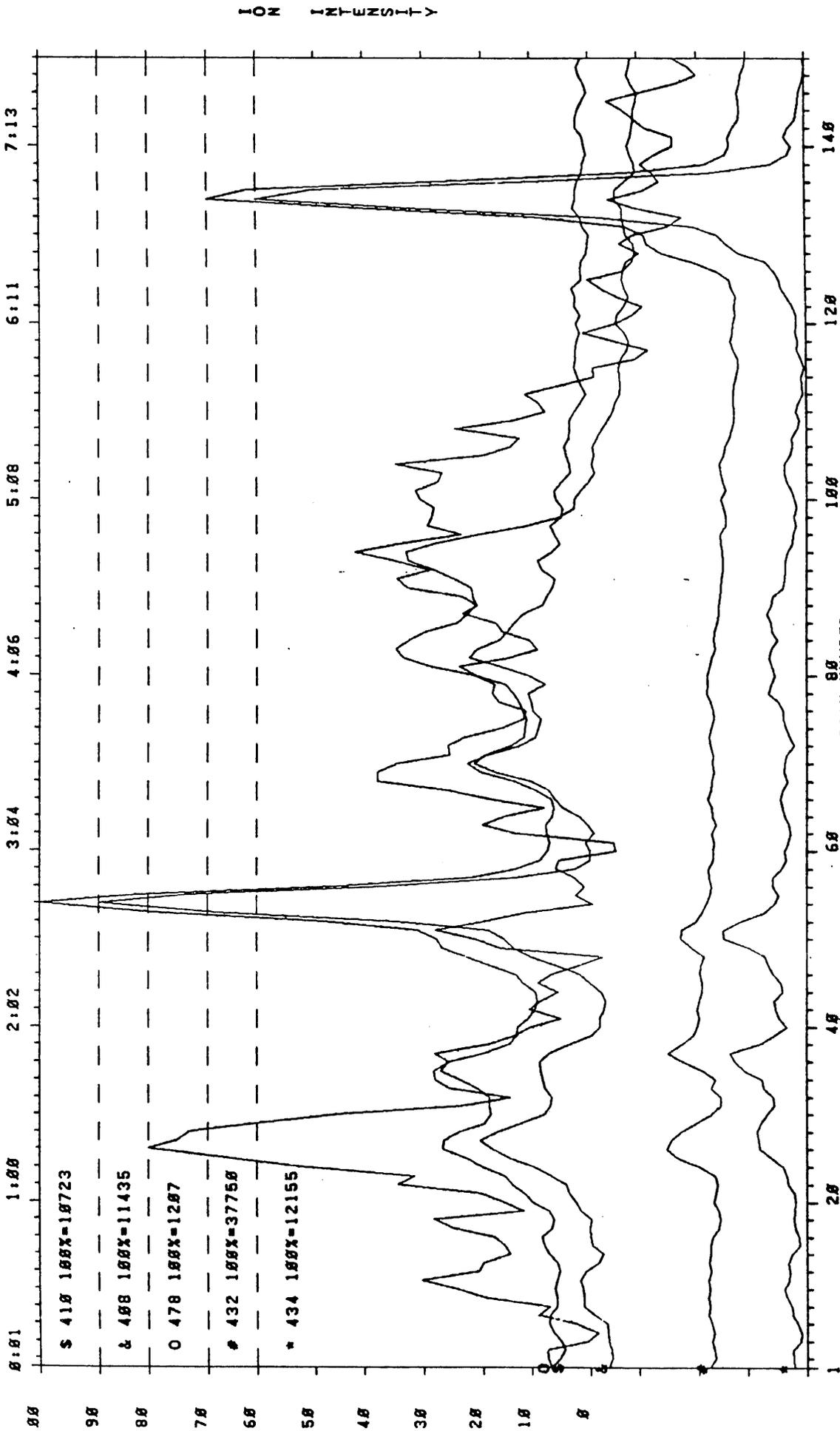
1 50 100 150 200 250 300

SCAN NUMBER
HEXACHLORODIBENZO-P-DIOXINS ANALYSIS OBTAINED FOR CHEMICALS
SAMPLE NO. 242 17 F
FIGURE: 448

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

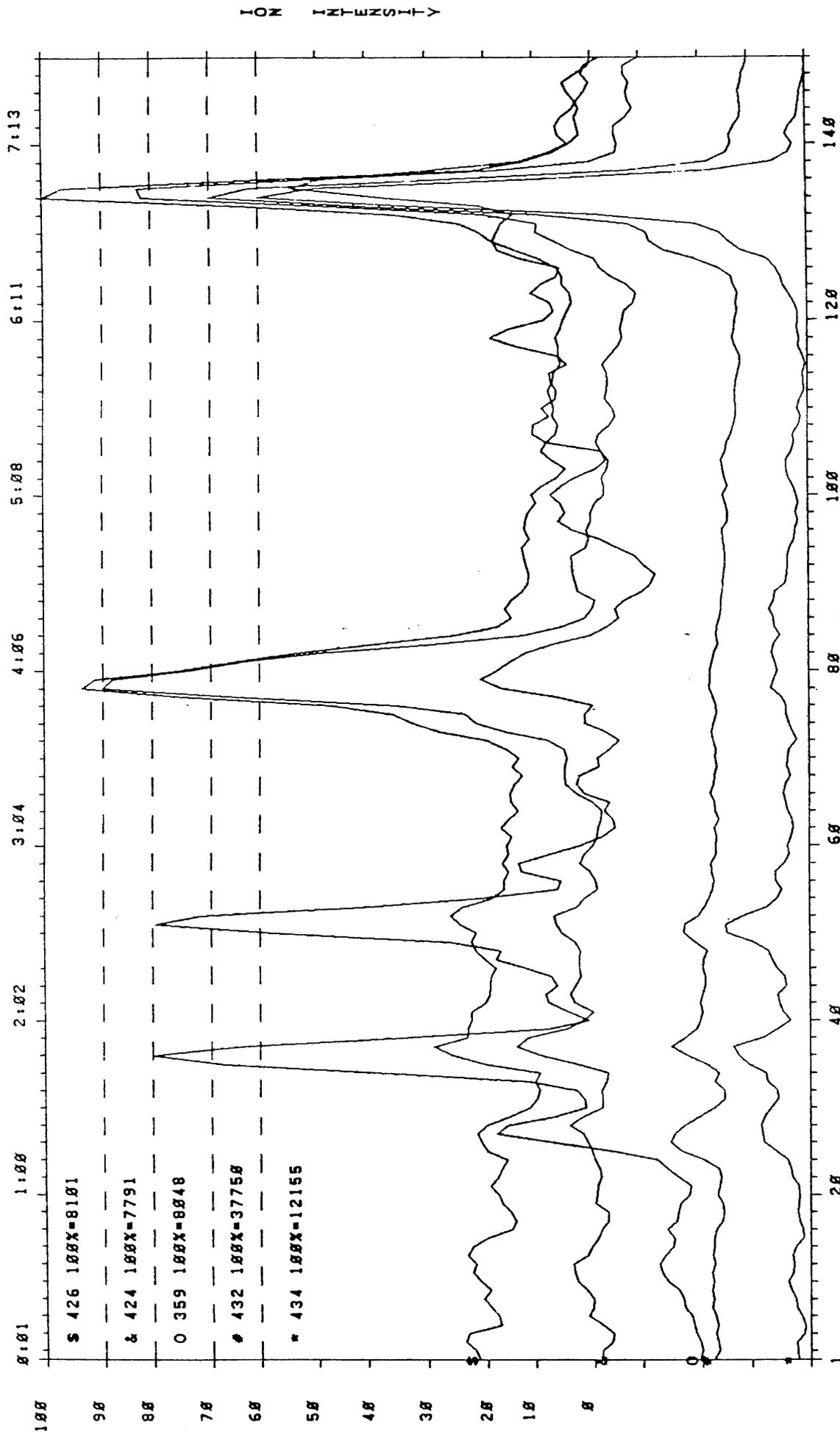
DATE: 03/02/84 TIME: 12:35

KRATOS MS25, DS55 SOFTWARE, RUN: TOR70065, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZOFURANS



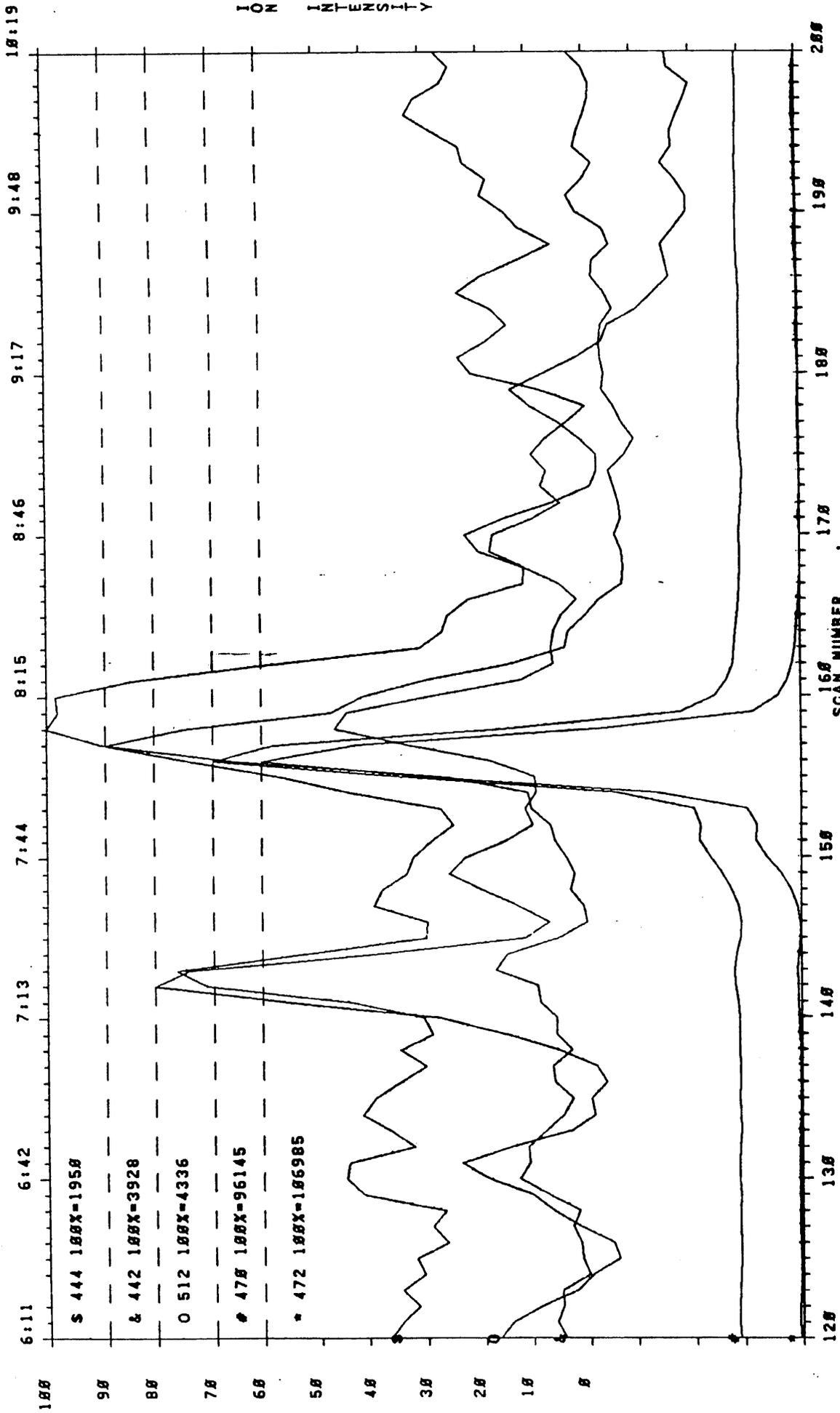
MASS-LIMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO. 2A2 17 F
SCAN NUMBER
FIGURE: 449

LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:35
KRATOS MS25, DS55 SOFTWARE, RUN: TOR70065, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR HEPTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2 17 F
FIGURE: 450

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435
DATE: 03/02/84 TIME: 12:47
KRATOS MS25, DS55 SOFTWARE, RUN: TOR0071, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZOFURANS

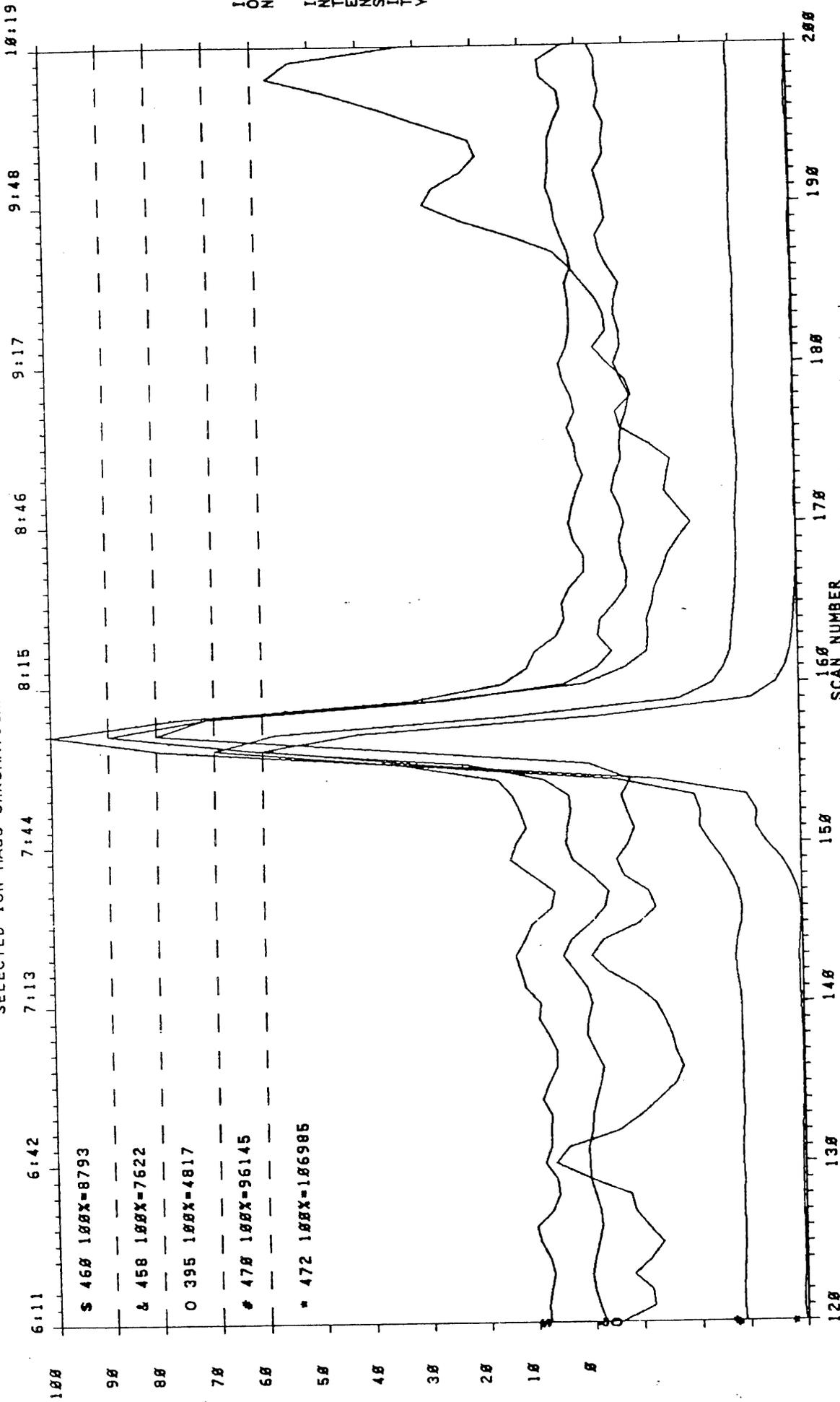


HRGC-LRMS ANALYSIS OBTAINED FOR CHEMECOLOGY SAMPLE NO.2A2 17 F
FIGURE: 451

BREHM LABORATORY - WRIGHT STATE UNIVERSITY - DAYTON, OHIO 45435

DATE: 03/02/84 TIME: 12:47

KRATOS MS25, DS55 SOFTWARE, RUN: TOR80071, WSU NAME: CHJ-69
SELECTED-ION MASS CHROMATOGRAMS FOR OCTACHLORODIBENZO-P-DIOXINS



HRGC-LRMS ANALYSIS OBTAINED FOR CHEMICOLOGY SAMPLE NO.2A2 17 F
SCAN NUMBER 160
FIGURE: 452

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2A1
LOCATION : Combustor Outlet

CONCENTRATION @ 12% CO2	4441.0 ms/Nm3	1.8087 gr/DScf
@ ACT CO2	3330.8 ms/Nm3	1.3565 gr/DScf
	965.1 ms/Ac3	0.4218 gr/Acf

EMISSION RATE	19.021 g/s	150.96 lb/hr
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SAMPLING VOLUME	0.7952 Nm3	30.132 DScf
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AVERAGE ISOKINETICITY	122.0 %
-----------------------	---------

FLUE GAS CHARACTERISTICS

MOISTURE	34.68 %
----------	---------

TEMPERATURE	341.9 des C	647.5 des F
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FLOW	20558 Nm3/hr	12983 DScfm
	70840 m3/hr	41754 Acfm

VELOCITY	13.08 m/s	2575.6 fpm
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GAS ANALYSIS

O2	11.00 %
CO2	9.00 %
CO	0.00 %
MOL. WT.	29.9 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 des C, 101.325 kPa
IMPERIAL 68 des F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2A1
LOCATION : Combustor Outlet

STACK DIAMETER	1.00 m	39.5 in.
STACK AREA	1.506 m ²	16.2 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-622.6 Pa	-2.50 in.H ₂ O
NOZZLE DIAMETER	8.00 mm	0.32 in.
PITOT COEFFICIENT	0.800	
METER CORRECTION FACTOR	0.987	
CONDENSATION IN IMPINGER 1	339.0 ml	
CONDENSATION IN IMPINGER 2	0.0 ml	
CONDENSATION IN IMPINGER 3	0.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	0.0 ml	
TOTAL CONDENSATION	339.0 ml	
FILTER PARTICULATE	2.4100 g	
WASHINGS PARTICULATE	0.0000 g	
IMPINGER PARTICULATE	0.2390 g	
TOTAL PARTICULATE	2.6490 g	
SAMPLING TIME	57.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2A2
LOCATION : A-Combustor Outlet

CONCENTRATION @ 12% CO2	6303.8 mg/Nm ³	2.5673 gr/DScf
@ ACT CO2	4412.6 mg/Nm ³	1.7971 gr/DScf
	1430.7 mg/Acft	0.6253 gr/Acf

EMISSION RATE	24.575 g/s	195.04 lb/hr
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SAMPLING VOLUME	0.6720 Nm ³	25.466 DScf
-----------------	------------------------	-------------

AVERAGE ISOKINETICITY	100.4 %
-----------------------	---------

FLUE GAS CHARACTERISTICS

MOISTURE	27.91 %
----------	---------

TEMPERATURE	333.5 deg C	632.3 deg F
-------------	-------------	-------------

FLOW	20049 Nm ³ /hr	12662 DScfm
	61827 m ³ /hr	36390 Acfm

VELOCITY	11.40 m/s	2244.7 fpm
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GAS ANALYSIS

O ₂	12.20 %
CO ₂	8.40 %
CO	0.00 %
MOL. WT.	29.8 g/s MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2A2
LOCATION : A-Combustor Outlet

STACK DIAMETER	1.00 m	39.5 in.
STACK AREA	1.506 m ²	16.2 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-622.6 Pa	-2.50 in.H ₂ O
NOZZLE DIAMETER	8.00 mm	0.32 in.
PITOT COEFFICIENT	0.800	
METER CORRECTION FACTOR	0.987	
CONDENSATION IN IMPINGER 1	190.0 ml	
CONDENSATION IN IMPINGER 2	6.6 ml	
CONDENSATION IN IMPINGER 3	0.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	12.3 ml	
TOTAL CONDENSATION	208.9 ml	
FILTER PARTICULATE	2.5400 g	
WASHINGS PARTICULATE	0.0000 g	
IMPINGER PARTICULATE	0.4260 g	
TOTAL PARTICULATE	2.9660 g	
SAMPLING TIME	60.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2B1
LOCATION : Venturi Inlet

CONCENTRATION @ 12% CO2	4496.9 mg/Nm3	1.8314 gr/DScf
@ ACT CO2	3185.3 mg/Nm3	1.2973 gr/DScf
	1039.9 mg/Ac3	0.4545 gr/Acf

EMISSION RATE	18.381 g/s	145.88 lb/hr
---------------	------------	--------------

SAMPLING VOLUME	0.7631 Nm3	28.915 DScf
-----------------	------------	-------------

AVERAGE ISOKINETICITY	113.2 %
-----------------------	---------

FLUE GAS CHARACTERISTICS

MOISTURE	37.01 %
----------	---------

TEMPERATURE	250.0 deg C	482.1 deg F
-------------	-------------	-------------

FLOW	20773 Nm3/hr	13119 DScfm
	63619 m3/hr	37445 Acfm

VELOCITY	12.42 m/s	2444.1 fpm
----------	-----------	------------

GAS ANALYSIS

O2	11.70 %
CO2	8.50 %
CO	0.00 %
MOL. WT.	29.8 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2B1
LOCATION : Venturi Inlet

STACK DIAMETER	1.35 m	53.0 in.
STACK AREA	1.423 m ²	15.3 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-1245.2 Pa	-5.00 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.820	
METER CORRECTION FACTOR	0.998	
CONDENSATION IN IMPINGER 1	324.2 ml	
CONDENSATION IN IMPINGER 2	22.4 ml	
CONDENSATION IN IMPINGER 3	0.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	13.3 ml	
TOTAL CONDENSATION	359.9 ml	
FILTER PARTICULATE	0.8110 g	
WASHINGS PARTICULATE	1.6090 g	
IMPINGER PARTICULATE	0.0110 g	
TOTAL PARTICULATE	2.4310 g	
SAMPLING TIME	72.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.JB11

DATE : 10-14-83
RUN : 2B2
LOCATION : Venturi Inlet

CONCENTRATION @ 12% CO2	6019.5 mg/Nm3	2.4515 gr/DScf
@ ACT CO2	4013.0 mg/Nm3	1.6344 gr/DScf
	1446.3 mg/Ac3	0.6321 gr/Acf
EMISSION RATE	22.545 g/s	178.93 lb/hr
SAMPLING VOLUME	0.7489 Nm3	28.380 DScf
AVERAGE ISOKINETICITY	114.1 %	

FLUE GAS CHARACTERISTICS

MOISTURE	30.77 %	
TEMPERATURE	247.7 deg C	477.9 deg F
FLOW	20225 Nm3/hr	12773 DScfm
	56107 m3/hr	33023 Acfm
VELOCITY	10.95 m/s	2155.5 fpm

GAS ANALYSIS

O2	12.40 %
CO2	8.00 %
CO	0.00 %
MOL. WT.	29.8 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.JB11

DATE : 10-14-83
RUN : 2B2
LOCATION : Venturi Inlet

STACK DIAMETER	1.35 m	53.0 in.
STACK AREA	1.423 m ²	15.3 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-1245.2 Pa	-5.00 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.820	
METER CORRECTION FACTOR	0.998	
CONDENSATION IN IMPINGER 1	317.5 ml	
CONDENSATION IN IMPINGER 2	-65.5 ml	
CONDENSATION IN IMPINGER 3	0.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	15.2 ml	
TOTAL CONDENSATION	267.2 ml	
FILTER PARTICULATE	0.6600 g	
WASHINGS PARTICULATE	2.3110 g	
IMPINGER PARTICULATE	0.0350 g	
TOTAL PARTICULATE	3.0060 g	
SAMPLING TIME	72.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

FIELD DATA
 CONCORD SCIENTIFIC CORPORATION
 REF. No. : 110.J811

DATE : 10-14-83
 RUN : 2B2
 LOCATION : Venturi Inlet

PT. NO.	TIME min	STACK TEMP des F	VEL. PRESS in.H2O	DRIF. PRESS in.H2O	METER VOL. cu.ft.	METER TEMP des F	HTBOX TEMP des F	IMP. TEMP des F	XAD2 TEMP des F	VAC. in.Hg	WALL DIST. in.	% ISO.
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TRAVERSE NO: 1

24	0.0	495	0.38	1.61	383.87	55	360	60	60	3.0	52.4	0.0
23	3.0	490	0.32	1.41	383.87	65	360	60	60	3.0	51.3	0.0
22	6.0	490	0.32	1.40	383.87	60	360	60	60	3.0	50.1	0.0
21	9.0	490	0.38	1.60	383.87	50	360	60	60	3.0	48.8	0.0
20	12.0	490	0.42	1.77	383.87	60	360	60	60	3.0	47.5	0.0
19	15.0	490	0.50	2.06	383.87	60	360	60	60	3.0	46.0	0.0
18	18.0	490	0.42	1.77	383.87	60	360	60	60	3.0	44.4	0.0
17	21.0	490	0.30	1.33	383.87	65	360	60	60	3.0	42.7	0.0
16	24.0	490	0.24	1.08	383.87	60	360	60	60	3.0	40.8	0.0
15	27.0	440	0.19	0.93	383.87	65	360	60	60	3.0	38.6	0.0
14	30.0	480	0.14	0.68	383.87	65	360	60	60	3.0	35.9	0.0
13	33.0	480	0.20	0.92	383.87	55	360	60	60	3.0	31.9	0.0
12	36.0	480	0.18	0.84	383.87	60	360	60	60	3.0	21.1	0.0
11	39.0	470	0.15	0.72	383.87	60	360	60	60	3.0	17.1	0.0
10	42.0	480	0.14	0.67	383.87	60	360	60	60	3.0	14.4	0.0
9	45.0	480	0.10	0.49	383.87	60	360	60	60	3.0	12.2	0.0
8	48.0	475	0.10	0.49	383.87	60	360	60	60	3.0	10.3	0.0
7	51.0	470	0.12	0.59	383.87	60	360	60	60	3.0	8.6	0.0
6	54.0	440	0.10	0.52	383.87	70	360	60	60	3.0	7.0	0.0
5	57.0	480	0.14	0.67	383.87	60	360	60	60	3.0	5.5	0.0
4	60.0	470	0.18	0.85	383.87	60	360	60	60	3.0	4.2	0.0
3	63.0	470	0.18	0.85	383.87	60	360	60	60	3.0	2.9	0.0
2	66.0	470	0.18	0.85	383.87	60	360	60	60	3.0	1.7	0.0
1	69.0	470	0.18	0.85	383.87	60	360	60	60	3.0	0.6	3005.2
	72.0				411.70							

AVERAGE 478 0.22 0.99

114.1

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2C1
LOCATION : Bashouse Inlet

CONCENTRATION @ 12% CO2	3099.8 mg/Nm3	1.2624 gr/DScf
@ ACT CO2	1653.2 mg/Nm3	0.6733 gr/DScf
	663.3 mg/Ac3	0.2899 gr/Acf

EMISSION RATE	13.735 g/s	109.01 lb/hr
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SAMPLING VOLUME	0.9516 Nm3	36.058 DScf
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AVERAGE ISOKINETICITY	98.5 %
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FLUE GAS CHARACTERISTICS

MOISTURE	25.86 %
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TEMPERATURE	226.3 deg C	439.3 deg F
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FLOW	29909 Nm3/hr	18889 DScfm
	74537 m3/hr	43871 Acfm

VELOCITY	15.11 m/s	2974.7 fpm
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GAS ANALYSIS

O2	14.00 %
CO2	6.40 %
CO	0.00 %
MOL. WT.	29.6 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2C1
LOCATION : Bashouse Inlet

STACK DIAMETER	1.32 m	52.0 in.
STACK AREA	1.370 m ²	14.7 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-1569.0 Pa	-6.30 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.820	
METER CORRECTION FACTOR	0.995	
CONDENSATION IN IMPINGER 1	141.6 ml	
CONDENSATION IN IMPINGER 2	109.6 ml	
CONDENSATION IN IMPINGER 3	3.8 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	11.5 ml	
TOTAL CONDENSATION	266.5 ml	
FILTER PARTICULATE	0.4670 g	
WASHINGS PARTICULATE	1.0790 g	
IMPINGER PARTICULATE	0.0274 g	
TOTAL PARTICULATE	1.5734 g	
SAMPLING TIME	69.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

FIELD DATA
 CONCORD SCIENTIFIC CORPORATION
 REF. No. : 110.JB11

DATE : 10-14-83
 RUN : 2C1
 LOCATION : Bashouse Inlet

PT. NO.	TIME min	STACK TEMP des F	VEL. PRESS in.H2O	DRIF. PRESS in.H2O	METER VOL. cu.ft.	METER TEMP des F	HTBOX TEMP des F	IMP. TEMP des F	XAD2 TEMP des F	VAC. in.Hg	WALL DIST. in.	% ISO.
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TRAVERSE NO: 1

12	0.0	440	0.68	3.19	390.06	65	400	60	60	3.0	50.9	0.0
11	3.0	440	0.64	3.02	390.06	65	400	60	60	3.0	48.5	0.0
10	6.0	440	0.60	2.86	390.06	65	400	60	60	3.0	45.9	0.0
9	9.0	440	0.52	2.52	390.06	65	400	60	60	3.0	42.8	0.0
8	12.0	440	0.58	2.77	390.06	65	400	60	60	3.0	39.0	0.0
7	15.0	440	0.40	2.02	390.06	70	400	60	60	3.0	33.5	0.0
6	18.0	435	0.24	1.29	390.06	65	400	60	60	3.0	18.5	0.0
5	21.0	440	0.24	1.28	390.06	65	400	60	60	3.0	13.0	0.0
4	24.0	440	0.24	1.28	390.06	65	400	60	60	3.0	9.2	0.0
3	27.0	440	0.30	1.56	390.06	65	400	60	60	3.0	6.1	0.0
2	30.0	440	0.26	1.37	390.06	60	400	60	60	3.0	3.5	0.0
1	33.0	440	0.26	1.38	390.06	65	400	60	60	3.0	1.1	1318.2
	36.0				406.05							

TRAVERSE NO: 2

12	0.0	440	0.78	3.57	408.01	60	400	60	60	3.0	50.9	0.0
11	3.0	440	0.80	3.66	408.01	60	400	60	60	3.0	48.5	0.0
10	6.0	440	0.76	3.52	408.01	65	400	60	60	3.0	45.9	0.0
9	9.0	440	0.65	3.06	408.01	65	400	60	60	3.0	42.8	0.0
8	12.0	440	0.60	2.86	408.01	65	400	60	60	3.0	39.0	0.0
7	15.0	440	0.56	2.67	408.01	60	400	60	60	3.0	33.5	0.0
6	18.0	445	0.28	1.45	408.01	60	400	60	60	3.0	18.5	0.0
5	21.0	440	0.26	1.38	408.01	65	400	60	60	3.0	13.0	0.0
4	24.0	435	0.30	1.57	408.01	65	400	60	60	3.0	9.2	0.0
3	27.0	435	0.30	1.57	408.01	65	400	60	60	3.0	6.1	0.0
2	30.0	435	0.34	1.75	408.01	65	400	60	60	3.0	3.5	1411.8
	33.0				427.63							

AVERAGE 439 0.44 2.16 98.5

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2C2
LOCATION : Bashouse Inlet

CONCENTRATION @ 12% CO2	9899.5 mg/Nm3	4.0317 gr/DScf
@ ACT CO2	5197.2 mg/Nm3	2.1167 gr/DScf
	2011.6 mg/Ac3	0.8792 gr/Acf
EMISSION RATE	39.023 g/s	309.71 lb/hr
SAMPLING VOLUME	0.8982 Nm3	34.036 DScf
AVERAGE ISOKINETICITY	98.6 %	

FLUE GAS CHARACTERISTICS

MOISTURE	28.67 %	
TEMPERATURE	226.0 deg C	438.8 deg F
FLOW	27030 Nm3/hr 69826 m3/hr	17071 DScfm 41098 Acfm
VELOCITY	14.16 m/s	2786.7 fpm

GAS ANALYSIS

O2	14.10 %
CO2	6.30 %
CO	0.00 %
MOL. WT.	29.6 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2C2
LOCATION : Bashouse Inlet

STACK DIAMETER	1.32 m	52.0 in.
STACK AREA	1.370 m ²	14.7 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-1369.7 Pa	-5.50 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.820	
METER CORRECTION FACTOR	0.995	
CONDENSATION IN IMPINGER 1	264.9 ml	
CONDENSATION IN IMPINGER 2	0.2 ml	
CONDENSATION IN IMPINGER 3	7.9 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	16.8 ml	
TOTAL CONDENSATION	289.8 ml	
FILTER PARTICULATE	1.5340 g	
WASHINGS PARTICULATE	3.0000 g	
IMPINGER PARTICULATE	0.1350 g	
TOTAL PARTICULATE	4.6690 g	
SAMPLING TIME	72.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

FIELD DATA
 CDNCORD SCIENTIFIC CORPORATION
 REF. No. : 110.J811

DATE : 10-14-83
 RUN : 2C2
 LOCATION : Bashouse Inlet

PT. NO.	TIME min	STACK TEMP des F	VEL. PRESS in.H2O	DRIF. PRESS in.H2O	METER VOL. cu.ft.	METER TEMP des F	HTBOX TEMP des F	IMP. TEMP des F	XAD2 TEMP des F	VAC. in.Hg	WALL DIST. in.	% ISO.
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TRAVERSE NO: 1

12	0.0	435	0.42	1.89	428.30	55	330	60	60	3.0	50.9	0.0
11	3.0	460	0.54	2.32	428.30	60	330	60	60	3.0	48.5	0.0
10	6.0	430	0.49	2.19	428.30	60	330	60	60	3.0	45.9	0.0
9	9.0	435	0.62	2.70	428.30	65	330	60	60	3.0	42.8	0.0
8	12.0	435	0.62	2.70	428.30	65	330	60	60	3.0	39.0	0.0
7	15.0	435	0.36	1.68	428.30	65	330	60	60	3.0	33.5	0.0
6	18.0	435	0.21	1.04	428.30	65	330	60	60	3.0	18.5	0.0
5	21.0	435	0.21	1.04	428.30	65	330	60	60	3.0	13.0	0.0
4	24.0	435	0.21	1.04	428.30	65	330	60	60	3.0	9.2	0.0
3	27.0	435	0.20	1.00	428.30	65	330	60	60	3.0	6.1	0.0
2	30.0	435	0.26	1.26	428.30	65	330	60	60	3.0	3.5	25.4
1	33.0	435	0.26	1.26	428.60	65	330	60	60	3.0	1.1	1325.4
	36.0				444.23							

TRAVERSE NO: 2

12	0.0	435	0.58	2.53	444.23	60	350	60	60	3.0	50.9	0.0
11	3.0	435	0.69	2.98	444.23	70	350	60	60	3.0	48.5	0.0
10	6.0	435	0.69	2.98	444.23	70	350	60	60	3.0	45.9	0.0
9	9.0	445	0.62	2.69	444.23	70	350	60	60	3.0	42.8	0.0
8	12.0	470	0.18	0.87	444.23	60	350	60	60	3.0	39.0	0.0
7	15.0	440	0.58	2.55	444.23	70	350	60	60	3.0	33.5	0.0
6	18.0	440	0.40	1.83	444.23	65	350	60	60	3.0	18.5	0.0
5	21.0	440	0.23	1.13	444.23	70	350	60	60	3.0	13.0	0.0
4	24.0	440	0.25	1.21	444.23	65	350	60	60	3.0	9.2	0.0
3	27.0	440	0.31	1.48	444.23	70	350	60	60	3.0	6.1	0.0
2	30.0	435	0.34	1.61	444.23	70	350	60	60	3.0	3.5	0.0
1	33.0	435	0.34	1.61	444.23	70	350	60	60	3.0	1.1	1308.6
	36.0				462.03							

AVERAGE 439 0.38 1.75 98.6

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2D1
LOCATION : D-Bashouse Outlet

CONCENTRATION @ 12% CO2	61.0 ms/Nm3	0.0248 gr/DScf
@ ACT CO2	32.5 ms/Nm3	0.0132 gr/DScf
	12.3 ms/Acf	0.0054 gr/Acf

EMISSION RATE	0.251 g/s	1.99 lb/hr
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SAMPLING VOLUME	0.9650 Nm3	36.566 DScf
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AVERAGE ISOKINETICITY	103.0 %
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FLUE GAS CHARACTERISTICS

MOISTURE	31.79 %
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TEMPERATURE	209.8 deg C	409.6 deg F
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FLOW	27788 Nm3/hr	17549 DScfm
	73634 m3/hr	43340 Acfm

VELOCITY	14.93 m/s	2938.7 fpm
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GAS ANALYSIS

O2	14.00 %
CO2	6.40 %
CO	0.00 %
MOL. WT.	29.6 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2D1
LOCATION : D-Bashouse Outlet

STACK DIAMETER	1.32 m	52.0 in.
STACK AREA	1.370 m ²	14.7 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-2739.5 Pa	-11.00 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.810	
METER CORRECTION FACTOR	0.988	
CONDENSATION IN IMPINGER 1	308.5 ml	
CONDENSATION IN IMPINGER 2	34.9 ml	
CONDENSATION IN IMPINGER 3	2.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	15.6 ml	
TOTAL CONDENSATION	361.0 ml	
FILTER PARTICULATE	0.0050 g	
WASHINGS PARTICULATE	0.0090 g	
IMPINGER PARTICULATE	0.017 ₄ g	
TOTAL PARTICULATE	0.0314 g	
SAMPLING TIME	72.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.

PARTICULATE EMISSION REPORT
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2D2
LOCATION : D-Bashouse Outlet

CONCENTRATION @ 12% CO2	559.1 mg/Nm ³	0.2277 gr/DScf
@ ACT CO2	279.5 mg/Nm ³	0.1138 gr/DScf
	114.7 mg/AcF	0.0501 gr/AcF

EMISSION RATE	2.010 g/s	15.95 lb/hr
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SAMPLING VOLUME	0.8012 Nm ³	30.360 DScf
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AVERAGE ISOKINETICITY	91.8 %
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FLUE GAS CHARACTERISTICS

MOISTURE	27.45 %
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TEMPERATURE	199.2 deg C	390.6 deg F
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FLOW	25879 Nm ³ /hr	16344 DScfm
	63074 m ³ /hr	37124 Acfm

VELOCITY	12.79 m/s	2517.2 fpm
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GAS ANALYSIS

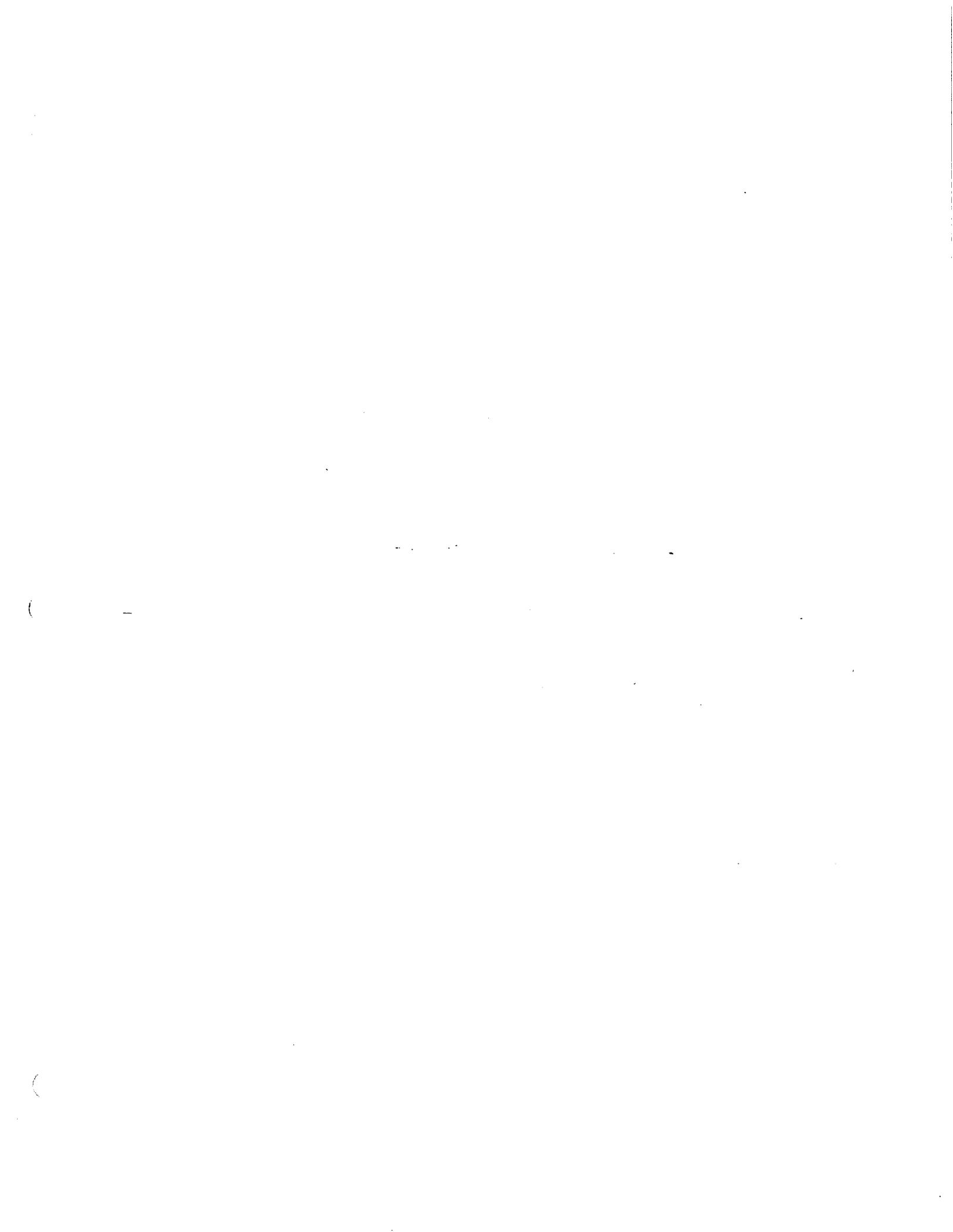
O2	14.60 %
CO2	6.00 %
CO	0.00 %
MOL. WT.	29.6 g/g MOLE (DRY)

*STANDARD CONDITIONS : METRIC 20 deg C, 101.325 kPa
IMPERIAL 68 deg F, 29.92 in. Hg

SAMPLING DATA
CONCORD SCIENTIFIC CORPORATION
REF. No. : 110.J811

DATE : 10-14-83
RUN : 2D2
LOCATION : D-Bashouse Outlet

STACK DIAMETER	1.32 m	52.0 in.
STACK AREA	1.370 m ²	14.7 sq.ft.
BAROMETRIC PRESSURE	101.8 kPa	30.06 in.Hg
STATIC PRESSURE	-2739.5 Pa	-11.00 in.H ₂ O
NOZZLE DIAMETER	7.00 mm	0.28 in.
PITOT COEFFICIENT	0.810	
METER CORRECTION FACTOR	0.988	
CONDENSATION IN IMPINGER 1	221.9 ml	
CONDENSATION IN IMPINGER 2	7.0 ml	
CONDENSATION IN IMPINGER 3	1.0 ml	
CONDENSATION IN IMPINGER 4	0.0 ml	
CONDENSATION IN IMPINGER 5	0.0 ml	
CONDENSATION IN IMPINGER 6	13.5 ml	
TOTAL CONDENSATION	243.4 ml	
FILTER PARTICULATE	0.0080 g	
WASHINGS PARTICULATE	0.0110 g	
IMPINGER PARTICULATE	0.2050 g	
TOTAL PARTICULATE	0.2240 g	
SAMPLING TIME	72.0 min.	
STACK HEIGHT	0.00 m	0.0 ft.



CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
SAMPLING LOCATION : B-Venturi Inlet RUN : 381M START TIME : 0036
STACK GAS TEMPERATURE(TS) : 485.00 DEG.F 251.67 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
STACK GAS VELOCITY(U) : 50.2 FPS 15.3 M/SEC ESTIMATE STACK GAS MOISTURE : 32.30 %
CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)^2*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.138 INCHES
DUCT CROSS SECTION : 53.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
GAS METER CORRECTION FACTOR : 0.9980 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE		VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IX
						IN (DEG.F)	OUT (DEG.F)			
12	0.0	485.0	0.42	0.68	412.60	65.0	65.0	2.0	0.0	141.82
	30.0				417.50					
AVERAGES		485.0	0.42	0.68		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB

CITY AND PROVINCE :

DATE : 10-15-83

SAMPLING LOCATION : B-Venturi Inlet

RUN : 381M

START TIME : 0036

TOTAL SAMPLE VOLUME: 4.95 DSCF 0.131 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.442 ACFM 0.013 AM3/MIN
 TOTAL IMPINGER CATCH: 50.6 ML.
 AVERAGE STACK TEMPERATURE: 485.0 DEG.F 251.7 DEG.C
 AVERAGE ISOKINETIC: 141.8 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	6.00	8.90
O2	7.49	11.10
CO	0.01	0.01
N2(BY DIFFERENCE)	53.95	79.99
H2O	32.55	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 242.726 MICROPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.0770	91.67	100.00	8.33	12.24
2	0.0000	0.00	8.33	8.33	6.93
3	0.0000	0.00	8.33	8.33	5.26
4	0.0070	8.33	8.33	-0.00	2.60
5	0.0000	0.00	-0.00	-0.00	1.46
FILTER	0.0000	0.00	-0.00		

TOTAL PARTICULATE WEIGHT : 0.0840 GRAMS

PARTICULATE CONCENTRATION

0.64301 G/NM3 0.26188 GRAINS/DSCF
 0.22409 G/AM3 0.09794 GRAINS/CF

CLIENT : CARB
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
LOCATION : B-Venturi Inlet
RUN NUMBER : 3B1M

TOTAL SAMPLE VOLUME: 0.131 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.013 AM3/MIN
TOTAL IMPINGER CATCH: 50.6 ML.
AVERAGE STACK TEMPERATURE: 251.7 DEG.C
AVERAGE ISOKINETIC: 141.8 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.0770	91.67	100.00
2	0.0000	0.00	8.33
3	0.0000	0.00	8.33
4	0.0070	8.33	8.33
5	0.0000	0.00	-0.00
FILTER	0.0000	0.00	-0.00

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
8.33	12.24
8.33	6.93
8.33	5.26
-0.00	2.60
-0.00	1.46

TOTAL PARTICULATE WEIGHT : 0.0840 GRAMS

PARTICULATE CONCENTRATION

0.64301 G/NM3 0.26188 GRAINS/DSCF
0.22409 G/AM3 0.09794 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : B-Venturi Inlet RUN : 382M START TIME : 0352
 STACK GAS TEMPERATURE(TS) : 485.00 DEG.F 251.67 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
 STACK GAS VELOCITY(U) : 49.9 FPS 15.2 M/SEC ESTIMATE STACK GAS MOISTURE : 29.20 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)^2*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 53.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9980 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE		VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IZ
						IN (DEG.F)	OUT (DEG.F)			
12	0.0	485.0	0.42	0.61	417.40	65.0	65.0	0.0	0.0	101.46
	45.0				424.55					
AVERAGES		485.0	0.42	0.61		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB

CITY AND PROVINCE :

DATE : 10-15-83

SAMPLING LOCATION : B-Venturi Inlet

RUN : 3B2M

START TIME : 0352

TOTAL SAMPLE VOLUME: 7.22 DSCF 0.191 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.411 ACFM 0.012 AM3/MIN
 TOTAL IMPINGER CATCH: 63.6 ML.
 AVERAGE STACK TEMPERATURE: 485.0 DEG.F 251.7 DEG.C
 AVERAGE ISOKINETIC: 101.5 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	5.79	8.20
O2	8.48	12.00
CO	0.01	0.01
N2(BY DIFFERENCE)	56.36	79.79
H2O	29.37	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 245.585 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.6000	80.65	100.00	19.35	12.93
2	0.0000	0.00	19.35	19.35	7.49
3	0.0000	0.00	19.35	19.35	5.72
4	0.0380	5.11	19.35	14.25	2.87
5	0.0000	0.00	14.25	14.25	1.61
FILTER	0.1060	14.25	14.25		

TOTAL PARTICULATE WEIGHT : 0.7440 GRAMS

PARTICULATE CONCENTRATION

3.90369 G/NM3 1.58984 GRAINS/DSCF
 1.42467 G/AM3 0.62267 GRAINS/CF

CLIENT : CARB
 FIVE STAGE SERIES CYCLONE
 PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
 LOCATION : B-Venturi Inlet
 RUN NUMBER : 3B2M

TOTAL SAMPLE VOLUME: 0.191 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.012 AM3/MIN
 TOTAL IMPINGER CATCH: 63.6 ML.
 AVERAGE STACK TEMPERATURE: 251.7 DEG.C
 AVERAGE ISOKINETIC: 101.5 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.6000	80.65	100.00
2	0.0000	0.00	19.35
3	0.0000	0.00	19.35
4	0.0380	5.11	19.35
5	0.0000	0.00	14.25
FILTER	0.1060	14.25	14.25

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
19.35	12.93
19.35	7.49
19.35	5.72
14.25	2.87
14.25	1.61

TOTAL PARTICULATE WEIGHT : 0.7440 GRAMS

PARTICULATE CONCENTRATION

3.90369 G/NM3 1.58984 GRAINS/DSCF
 1.42467 G/AM3 0.62267 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : B-Venturi Inlet RUN : 3B3M START TIME : 0725
 STACK GAS TEMPERATURE(TS) : 485.00 DEG.F 251.67 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
 STACK GAS VELOCITY(U) : 50.5 FPS 15.4 M/SEC ESTIMATE STACK GAS MOISTURE : 29.20 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)^2*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 53.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9980 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE IN (DEG.F)	METER TEMPERATURE OUT (DEG.F)	VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	%
12	0.0 30.0	485.0	0.42	0.66	425.60 430.40	65.0	65.0	2.0	0.0	106.78
AVERAGES		485.0	0.42	0.66		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB

CITY AND PROVINCE :

DATE : 10-15-83

SAMPLING LOCATION : B-Venturi Inlet

RUN : 383M

START TIME : 0725

TOTAL SAMPLE VOLUME: 4.85 DSCF 0.128 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.437 ACFM 0.012 AM3/MIN
 TOTAL IMPINGER CATCH: 50.9 ML.
 AVERAGE STACK TEMPERATURE: 485.0 DEG.F 251.7 DEG.C
 AVERAGE ISOKINETIC: 106.8 %

STACK GAS ANALYSIS

CONSTITUENT	NET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	4.55	6.80
O2	8.83	13.20
CO	0.01	0.01
N2(BY DIFFERENCE)	53.49	79.99
H2O	33.13	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 242.989 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.4230	76.63	100.00	23.37	12.33
2	0.0000	0.00	23.37	23.37	7.01
3	0.0000	0.00	23.37	23.37	5.32
4	0.0410	7.43	23.37	15.94	2.64
5	0.0000	0.00	15.94	15.94	1.48
FILTER	0.0880	15.94	15.94		

TOTAL PARTICULATE WEIGHT : 0.5520 GRAMS

PARTICULATE CONCENTRATION

4.31374 G/NM3 1.75684 GRAINS/DSCF
 1.49030 G/AM3 0.65135 GRAINS/CF

CLIENT : CARB
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
LOCATION : B-Venturi Inlet
RUN NUMBER : 3B3M

TOTAL SAMPLE VOLUME: 0.128 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.012 AM3/MIN
TOTAL IMPINGER CATCH: 50.9 ML.
AVERAGE STACK TEMPERATURE: 251.7 DEG.C
AVERAGE ISOKINETIC: 106.8 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.4230	76.63	100.00
2	0.0000	0.00	23.37
3	0.0000	0.00	23.37
4	0.0410	7.43	23.37
5	0.0000	0.00	15.94
FILTER	0.0880	15.94	15.94

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
23.37	12.33
23.37	7.01
23.37	5.32
15.94	2.64
15.94	1.48

TOTAL PARTICULATE WEIGHT : 0.5520 GRAMS

PARTICULATE CONCENTRATION

4.31374 G/NM3 1.75684 GRAINS/DSCF
1.49030 G/AM3 0.65135 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : C-Baghouse Inlet RUN : 3C1 START TIME : 0036
 STACK GAS TEMPERATURE(TS) : 450.00 DEG.F 232.22 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
 STACK GAS VELOCITY(U) : 53.9 FPS 16.4 M/SEC ESTIMATE STACK GAS MOISTURE : 27.00 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE Q=U*(NOZZLE DIAMETER)*528/(TS+460*(1-MC/100))*29.92/PB : 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 52.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9871 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE IN (DEG.F)	METER TEMPERATURE OUT (DEG.F)	VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IX
7	0.0 30.0	450.0	0.50	0.84	815.70 821.44	65.0	65.0	3.0	0.0	114.38
AVERAGES		450.0	0.50	0.84		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB

CITY AND PROVINCE :

DATE : 10-15-83

SAMPLING LOCATION : C-Bashhouse Inlet

RUN : 3C1

START TIME : 0036

TOTAL SAMPLE VOLUME: 5.74 DSCF 0.151 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.500 ACFM 0.014 AM3/MIN
 TOTAL IMPINGER CATCH: 59.2 ML.
 AVERAGE STACK TEMPERATURE: 450.0 DEG.F 232.2 DEG.C
 AVERAGE ISOKINETIC: 114.4 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	4.71	7.00
O2	8.74	13.00
CO	0.01	0.01
N2(BY DIFFERENCE)	53.79	79.99
H2O	32.75	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 235.788 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.4248	55.81	100.00	44.19	11.02
2	0.0000	0.00	44.19	44.19	6.00
3	0.0000	0.00	44.19	44.19	4.47
4	0.1849	24.29	44.19	19.90	2.18
5	0.0000	0.00	19.90	19.90	1.23
FILTER	0.1515	19.90	19.90		

TOTAL PARTICULATE WEIGHT : 0.7612 GRAMS

PARTICULATE CONCENTRATION

5.02709 G/NM3 2.04736 GRAINS/DSCF
 1.81382 G/AM3 0.79275 GRAINS/CF

CLIENT : CARB
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
LOCATION : C-Bashouse Inlet
RUN NUMBER : 3C1

TOTAL SAMPLE VOLUME: 0.151 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.014 AM3/MIN
TOTAL IMPINGER CATCH: 59.2 ML.
AVERAGE STACK TEMPERATURE: 232.2 DEG.C
AVERAGE ISOKINETIC: 114.4 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.4248	55.81	100.00
2	0.0000	0.00	44.19
3	0.0000	0.00	44.19
4	0.1849	24.29	44.19
5	0.0000	0.00	19.90
FILTER	0.1515	19.90	19.90

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
44.19	11.02
44.19	6.00
44.19	4.47
19.90	2.18
19.90	1.23

TOTAL PARTICULATE WEIGHT : 0.7612 GRAMS

PARTICULATE CONCENTRATION

5.02709 G/NM3 2.04736 GRAINS/DSCF
1.81382 G/AM3 0.79275 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : C-Bashouse Inlet RUN : 3C2M START TIME : 0352
 STACK GAS TEMPERATURE(TS) : 450.00 DEG.F 232.22 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
 STACK GAS VELOCITY(U) : 54.5 FPS 16.6 M/SEC ESTIMATE STACK GAS MOISTURE : 32.20 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)^2*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 52.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9871 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE IN (DEG.F)	METER TEMPERATURE OUT (DEG.F)	VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IZ
7	0.0 45.0	450.0	0.50	0.75	822.75 830.33	65.0	65.0	2.0	0.0	108.13
AVERAGES		450.0	0.50	0.75		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : C-Bashouse Inlet RUN : 3C2M START TIME : 0352

TOTAL SAMPLE VOLUME: 7.57 DSCF 0.200 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.479 ACFM 0.014 AM3/MIN
 TOTAL IMPINGER CATCH: 99.2 ML.
 AVERAGE STACK TEMPERATURE: 450.0 DEG.F 232.2 DEG.C
 AVERAGE ISOKINETIC: 108.1 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	4.08	6.60
O2	8.28	13.40
CO	0.01	0.01
N2 (BY DIFFERENCE)	49.43	79.99
H2O	38.20	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 231.413 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.2450	38.64	100.00	61.36	11.03
2	0.0000	0.00	61.36	61.36	6.01
3	0.0000	0.00	61.36	61.36	4.44
4	0.1890	29.81	61.36	31.55	2.20
5	0.0000	0.00	31.55	31.55	1.26
FILTER	0.2000	31.55	31.55		

TOTAL PARTICULATE WEIGHT : 0.6340 GRAMS

PARTICULATE CONCENTRATION

3.17140 G/NM3 1.29160 GRAINS/DSCF
 1.05155 G/AM3 0.45959 GRAINS/CF

CLIENT : CARB
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
LOCATION : C-Bashouse Inlet
RUN NUMBER : 3C2M

TOTAL SAMPLE VOLUME: 0.200 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.014 AM3/MIN
TOTAL IMPINGER CATCH: 99.2 ML.
AVERAGE STACK TEMPERATURE: 232.2 DEG.C
AVERAGE ISOKINETIC: 108.1 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.2450	38.64	100.00
2	0.0000	0.00	61.36
3	0.0000	0.00	61.36
4	0.1890	29.81	61.36
5	0.0000	0.00	31.55
FILTER	0.2000	31.55	31.55

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
61.36	11.03
61.36	6.01
61.36	4.44
31.55	2.20
31.55	1.26

TOTAL PARTICULATE WEIGHT : 0.6340 GRAMS

PARTICULATE CONCENTRATION

3.17140 G/NM3 1.29160 GRAINS/DSCF
1.05155 G/AM3 0.45959 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB CITY AND PROVINCE : DATE : 10-15-83
 SAMPLING LOCATION : C-Bashouse Inlet RUN : 3C3M START TIME : 0722
 STACK GAS TEMPERATURE(TS) : 450.00 DEG.F 232.22 DEG.C STACK GAS PRESSURE : -5.00 IN WG.
 STACK GAS VELOCITY(U) : 0.0 FPS 0.0 M/SEC ESTIMATE STACK GAS MOISTURE : 0.00 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)^2*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 52.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9871 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE		VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IZ
						IN (DEG.F)	OUT (DEG.F)			
7	0.0 30.0	450.0	0.50	0.75	831.85 836.72	65.0	65.0	2.0	0.0	96.36
AVERAGES		450.0	0.50	0.75		65.0	65.0			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CARB

CITY AND PROVINCE :

DATE : 10-15-83

SAMPLING LOCATION : C-Bashouse Inlet

RUN : 3C3M

START TIME : 0722

TOTAL SAMPLE VOLUME: 4.87 DSCF 0.128 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.421 ACFM 0.012 AM3/MIN
 TOTAL IMPINGER CATCH: 49.1 ML.
 AVERAGE STACK TEMPERATURE: 450.0 DEG.F 232.2 DEG.C
 AVERAGE ISOKINETIC: 96.4 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	4.47	6.60
O2	9.08	13.40
CO	0.01	0.01
N2(BY DIFFERENCE)	54.18	79.99
H2O	32.26	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 236.333 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.4680	58.28	100.00	41.72	12.15
2	0.0000	0.00	41.72	41.72	6.89
3	0.0000	0.00	41.72	41.72	5.16
4	0.2180	27.15	41.72	14.57	2.60
5	0.0000	0.00	14.57	14.57	1.49
FILTER	0.1170	14.57	14.57		

TOTAL PARTICULATE WEIGHT : 0.8030 GRAMS

PARTICULATE CONCENTRATION

6.25188 G/NM3 2.54618 GRAINS/DSCF
 2.27228 G/AM3 0.99313 GRAINS/CF

CLIENT : CARB
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN : 10-15-83
LOCATION : C-Baghouse Inlet
RUN NUMBER : 3C3M

TOTAL SAMPLE VOLUME: 0.128 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.012 AM3/MIN
TOTAL IMPINGER CATCH: 49.1 ML.
AVERAGE STACK TEMPERATURE: 232.2 DEG.C
AVERAGE ISOKINETIC: 96.4 %

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.4680	58.28	100.00
2	0.0000	0.00	41.72
3	0.0000	0.00	41.72
4	0.2180	27.15	41.72
5	0.0000	0.00	14.57
FILTER	0.1170	14.57	14.57

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
41.72	12.15
41.72	6.89
41.72	5.16
14.57	2.60
14.57	1.49

TOTAL PARTICULATE WEIGHT : 0.8030 GRAMS

PARTICULATE CONCENTRATION

6.25188 G/NM3 2.54618 GRAINS/DSCF
2.27228 G/AM3 0.99313 GRAINS/CF

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CITY AND PROVINCE : DATE :
 SAMPLING LOCATION : C-Bashhouse Inlet RUN : 3D1M START TIME : 2058
 STACK GAS TEMPERATURE(TS) : 0.00 DEG.F -17.78 DEG.C STACK GAS PRESSURE : 2-11.00 IN WG.
 STACK GAS VELOCITY(U) : 0.0 FPS 0.0 M/SEC ESTIMATE STACK GAS MOISTURE : 27.00 %
 CLASSIFICATION RANGE : 0.00 UM TO 0.00 UM DESIRED SAMPLE FLOW RATE : 0.000 ACFM
 GAS METER FLOW RATE $Q=U*(NOZZLE\ DIAMETER)*528/(TS+460*(1-MC/100))*29.92/PB$: 0.000 DSCFM
 REQUIRED ORIFICE PRESSURE : 0.00 IN WG. NOZZLE DIAMETER : 0.158 INCHES
 DUCT CROSS SECTION : 52.00 X 0.00 INCHES BAROMETRIC PRESSURE(PB) : 30.06 IN. MERCURY
 GAS METER CORRECTION FACTOR : 0.9871 CP PITOT: 0.820 CREW :

SAMPLE POINT	SAMPLE TIME (MIN.)	STACK TEMP. (DEG.F)	VELOCITY PRESSURE (IN.WG)	ORIFICE PRESSURE (IN.WG)	METER VOLUME (CU.FT.)	METER TEMPERATURE IN (DEG.F)	METER TEMPERATURE OUT (DEG.F)	VACUUM (IN.HG)	DISTANCE FROM WALL (INCHES)	IZ
7	0.0	410.0	0.56	0.49	848.30	60.0	60.0	0.0	0.0	61.58
7	300.0	410.0	0.56	0.49	880.66	55.0	55.0	2.0	0.0	153.52
	480.0				928.60					
AVERAGES		410.0	0.56	0.49		58.1	58.1			

CONCORD SCIENTIFIC CORPORATION

FIVE STAGE SERIES CYCLONE PARTICLE SIZE TEST DATA

CLIENT : CITY AND PROVINCE : DATE :
 SAMPLING LOCATION : C-Bashouse Inlet RUN : 3D1M START TIME : 2058

TOTAL SAMPLE VOLUME: 81.25 DSCF 2.144 NM3
 AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.439 ACFM 0.012 AM3/MIN
 TOTAL IMPINGER CATCH: 891.2 ML.
 AVERAGE STACK TEMPERATURE: 410.0 DEG.F 210.0 DEG.C
 AVERAGE ISOKINETIC: 96.1 %

STACK GAS ANALYSIS

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	4.41	6.70
O2	8.83	13.40
CO	0.01	0.01
N2(BY DIFFERENCE)	52.64	79.89
H2O	34.11	0.00
TOTAL	100.00	100.00

VISCOSITY OF STACK GAS : 226.189 MICRPOISE

CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE	CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
1	0.0020	26.67	100.00	73.33	11.25
2	0.0000	0.00	73.33	73.33	6.19
3	0.0000	0.00	73.33	73.33	4.52
4	0.0030	40.00	73.33	33.33	2.30
5	0.0000	0.00	33.33	33.33	1.35
FILTER	0.0025	33.33	33.33		

TOTAL PARTICULATE WEIGHT : 0.0075 GRAMS

PARTICULATE CONCENTRATION

0.00350 G/NM3 0.00142 GRAINS/DSCF
 0.00127 G/AM3 0.00056 GRAINS/CF

CLIENT :
FIVE STAGE SERIES CYCLONE
PARTICLE SIZE TEST DATA

DATE OF RUN :
LOCATION : C-Bashouse Inlet
RUN NUMBER : 3D1M

TOTAL SAMPLE VOLUME: 2.144 NM3
AVERAGE SAMPLING RATE (STACK CONDITIONS): 0.012 AM3/MIN
TOTAL IMPINGER CATCH: 891.2 ML.
AVERAGE STACK TEMPERATURE: 210.0 DEG.C
AVERAGE ISOKINETIC: 96.1 %

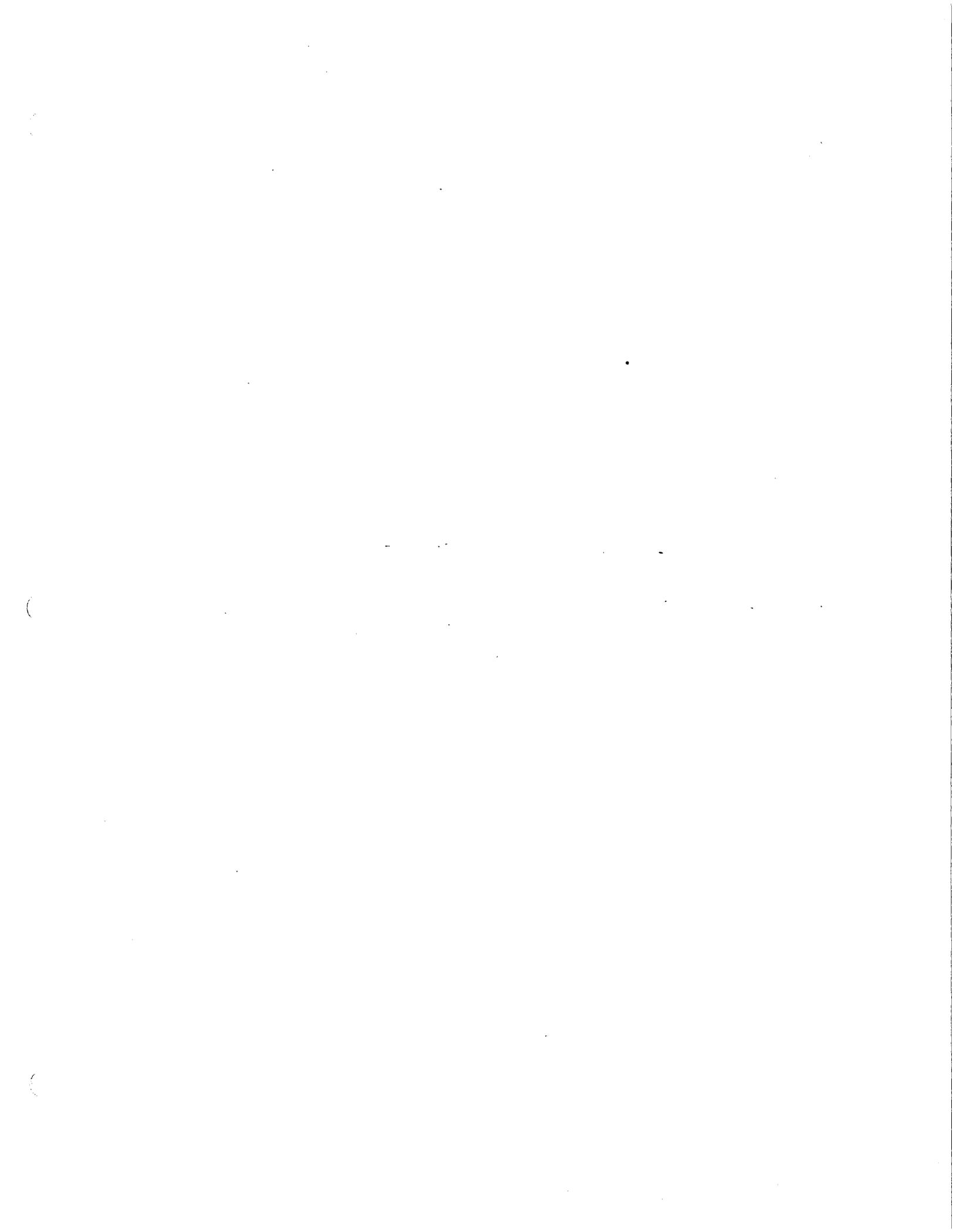
CYCLONE STAGE NUMBER	NET PARTICULATE WEIGHT (GRAMS)	PERCENTAGE OF TOTAL PARTICULATE WEIGHT	CUMULATIVE PERCENTAGE
1	0.0020	26.67	100.00
2	0.0000	0.00	73.33
3	0.0000	0.00	73.33
4	0.0030	40.00	73.33
5	0.0000	0.00	33.33
FILTER	0.0025	33.33	33.33

CUMULATIVE PERCENTAGE LESS THAN STATED D50 DIAMETER	D50 PARTICLE DIAMETER (UM)
73.33	11.25
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73.33	4.52
33.33	2.30
33.33	1.35

TOTAL PARTICULATE WEIGHT : 0.0075 GRAMS

PARTICULATE CONCENTRATION

0.00350 G/NM3 0.00142 GRAINS/DSCF
0.00127 G/AM3 0.00056 GRAINS/CF





John

Zenon Environmental Inc.

845 Harrington Court, Burlington, Ontario L7N 3P3 Canada Telephone: (416) 639-6320 Telex: 061-8734

July 2, 1986

Mr. John Chandler,
Senior Engineer
Concord Scientific Corporation
2 Tippett Road
DOWNSVIEW, Ontario.
M3H 2V2

Dear John:

I am enclosing the review comments you requested on the document entitled "The Results of Analyses of Combustion Products Collected During Tests of A Refuse-Fired Incinerator Located in Tsushima, Japan for Polychlorinated Dibenzodioxins and Dibenzofurans, Selected Metals and Fluorides/Chlorides".

Generally, the analytical report is thorough though some discrepancies in the data were noted. I have outlined these points, along with our suggestions, in the review.

I am available to discuss this further. Please feel free to call me.

Yours truly,

John A. Coburn
Vice President - Technical Services

JAC:mk

REVIEW COMMENTS ON THE WRIGHT STATE UNIVERSITY FINAL
REPORT ON THE COMBUSTION ANALYSES PERFORMED
ON THE TSUSHIMA INCINERATOR

Comments by:

John A. Coburn

ZENON ENVIRONMENTAL INC.

July 2, 1986

Sample Preparation

In general, there is good description of the samples, of the protocols used in their preparation and of the conditions of analysis.

While not a responsibility of the analysing laboratory, some comment on the conditions of shipment should have been provided in the laboratory report. It is not clear whether the samples were maintained in coolers at approximately 4°C.

The sub-dividing of certain samples (impinger solutions and XAD resins) allows one to speculate on the homogeneity (or lack of it) of the sub-samples. This sub-dividing should be avoided in tests of this sort.

The protocols for extractions, clean-up and HRGC/LRMS analysis of PCDD/PCDF are those stipulated by the A.S.M.E. Standards of at least one isomer for each congener group of PCDD/PCDF (from tetrachloro to octachloro) were identified in the data report. It would be useful for purities to be provided where known.

From the description provided, it is not clear if the retention windows for each "class" of CDD/CDF were verified through the use of earliest/latest eluting isomers or a fly ash extract. It seems that they were "estimated" in some cases and this leaves open to question the possibility of missed peaks in the analysis of the tetrachloro to hexachloro CDD/CDF congeners. This does not appear to be the case upon review of the extracted ion current profiles (EICP's).

The identification criteria used for the PCDD/PCDF identified only elution in the retention window and correct ion ratio $\pm 30\%$. This range is broader than the $\pm 15-20\%$ normally accepted for

PCDD/PCDF data. In addition, the LRMS analysis included monitoring of the $(M-Cl)^+$ ion and this is usually an identification criterion. The monitoring of the M^+ ion for the chlorinated diphenyl ethers with 2 chlorines more than the PCDF being monitored is also very useful and its absence must be a criterion for PCDF presence. One final identification criterion which is usually employed is the signal to noise ratio of 3:1 - 5:1 for the M^+ and $(M+2)^+$ ions. On the basis of the report it is not clear if these last 3 criteria were used.

General Comments on PCDD/PCDF Data Table

1. In virtually all samples, the impinger solutions were found to contain the highest amount of PCDD/PCDF. Was the train assembled with the impingers before the resin trap (à la MOE) or is this an indication of break through?
2. While the pattern for the PCDF is consistent with other reports, the PCDD pattern is quite the opposite compared to previous reports. In this study, the PCDD concentrations were shown to decrease from tetra to octa while just the reverse or a trend to maximize at the HxCDD was found in NITEP and other U.S. studies. No explanation is offered.
3. Relative total amounts of PCDD and PCDF are in line with those reported elsewhere.

4. Excellent recoveries of TCDD*, H_pCDD* and OCDD* are reported for all test samples.

5. Review of extraction ion current profiles (EICP's) revealed readily interpreted PCDD chromatograms. The same patterns were evident in the EICP's of the filters and impingers.

EICP's for the PCDF were obscured somewhat by the PCDPE ion which was usually a low level noise signal.

6. Retention time of the TCDD* was readily reproduceable from February 2, 1984 to April 10, 1984 which are the dates of EICP's provided.

7. On the basis of the EICP's supplied, it is not clear how the area measurements were taken for each peak and summed for use in calculating the resultant "class" concentration.

8. In comparing the 332 ion (C-13 TCDD) to 328 ion (C-37 TCDD) the ratio obtained were generally in good agreement with the % recovery values provided in Table 7. There were, however, some exceptions which were not understood.

Sample 2A2 impinger solutions had a reported ¹³C₁₂ - TCDD recovery of 93% yet the EICP's showed a 332/328 ratio of 33%.

Sample 2D2 reported a $^{13}\text{C}_{12}$ - TCDD recovery of 95% while the ratio of 332/328 was only 26% on the EICP.

In addition, the EICP's for the PCDD and PCDF on sample 2D1-Impingers were apparently analysed at two different times and the ratios of 332/328 were 72% and 14% in the two analyses. The former value is reported for the recovery of the $^{13}\text{C}_{12}$ TCDD internal standard (actually 73% is reported).

I don't understand these discrepancies, unless different spike levels were used.

9. In calculating the response of the ^{37}Cl -H_pCDD against the $^{37}\text{C}_4$ -TCDD response, similar discrepancies were found for sample 2D2-First Impinger and 2A2-Impingers. For other samples checked, there was internal consistency with the reported recovery and the relative response noted above.

Again no explanation is provided for this in the data report.

10. No EICP's for standards or blanks were provided so no actual calculations were performed as a check on the reported data.
11. The EICP's reveal very good chromatographic resolution and peak shape.

12. Example calculations and raw area measurements would permit verification of final data points.

Summarizing all of the above, I would say the analytical report is a competent and professional analytical package. There are some discrepancies which cannot be fully rationalized based upon the data package available for review. Some suggestions for future studies of this type are included in the review comments.

John A. Coburn





Environment
Canada

Environnement
Canada

Technology Development
and Technical Services Branch
Ottawa, K1A 0E7

Your file Votre référence

Our file Notre référence

July 23, 1986

4047-3

Mr. J. Chandler
Concord Scientific Corporation
2 Tippett Road
Toronto, Ontario
M3H 2V2

Dear Mr. Chandler:

Mr. M. Bumbaco has forwarded to me your letter concerning the results of analysis of combustion products performed by the Brehm Laboratory of the Wright State University.

As requested, Mr. Chiu and I have reviewed the report and consider that it is a well-prepared and useful document. Our comments and findings are as follows:

P6 Sec 2b: One-half of the XAD-2 was used to analyze the PCDD/PCDF contents. It could be that the Laboratory tried to save the other half of the sample for any future applications. The XAD resin is very difficult to homogenize in order to produce a representative sample in the one-half portion, as the PCDD/PCDF loading tends to be accumulated at the top of the XAD column. Perhaps the Brehm Laboratory has investigated this situation and established the criteria for homogeneity. The evidence, however, is not included in the report.

Canada

In order to conserve energy
and resources, this paper
contains post-consumer
fibre.

À des fins de conservation
de l'énergie et des ressources
ce papier contient des
fibres recyclées.

✓ P 6 Sec 2b No acid treatment step is included in the clean-up procedure for ash and filter samples. This treatment increases the surface areas of particulates, thus, as cited in the literature, the extraction efficiency. The protocol developed by our laboratory uses 1N HCl (MOE uses 6N HCl) and up to 40% of impurities can be washed away without any PCDD/PCDF losses.

It is interesting to note that both XAD resin and impinger samples were split but not the filter samples due probably to the difficulty of homogeneity.

✓ P 7 Sec 3a and 3b These procedures are not employed by our laboratory (nor MOE). Sample extracts are transferred directly to the clean-up columns and we have not encountered any problems of separation.

P 7 Sec 3h The statement that PCDDs and PCDFs were analyzed separately from the contents of two vessels is not supported in the text. The sequence of operations in Table 8 and the attached TIC plots from GC/MS runs indicate that these compounds were measured simultaneously, e.g., results of 2A2-17 filter were obtained at 12:08 PM, 03/03/84 for T4CDD and T4CDF, and so on.

✓ P 8 Sec 4a-2 The standard analytical columns used by this laboratory and MOE are 30 M DB-5 silica capillary. The purpose of using the 60 M column is based on the assumption that the resolutions of PCDD/PCDF congeners can be improved and that 2,3,7,8 TCDD is completely separated from other isomers. Results of extensive investigations in this laboratory indicate that the 60 M column fails to provide any appreciable improvement and, instead, the total chromatographic time for OCDD to be eluted is increased by about 25 minutes.

Since the advantages using 60 M column do not compensate for the additional time required for analysis, the use of 30 M column will be continued for the PCDD/PCDF work in this laboratory.



4a - 3

The accelerating voltage of 4 KV seems to be high. The typical Finnigan Model 4000 series GC/MS requires below 2 KV. The report does not provide signal/noise ratio and the detection limits, judging from the attached TIC plots, it indicates that electron energy was high and causing background problems and interferences.

P 9 Table A

As T4CDD and T4CDF were measured simultaneously with HxDPE, nine ions had to be monitored using the MID technique. In Figures 443 and 444, only eight ions were monitored with the absence of M/e 241, the daughter ion of T4CDF. The reason is obvious since the MID cannot accommodate all nine ions within the time-window of one second scanning without sensitivity loss. In NITEP samples, we investigated the presence of diphenyl ethers and none was found. For confirmation purposes, the M/e 241 ion might be monitored instead of HxDPE.

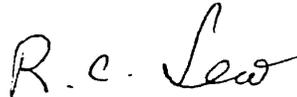
It is also noticed that the the fragment ion, M-COCl of PCDD/PCDF was listed in Table A for monitoring. In TIC plots, different ions were used, e.g., in Figures 444, 446, and 448, the monitored ions are M-COCl-2 (M/e 257), M-COCl (M/e 291) and M-COCl+2 (M/e 329) respectively. Evidently these ions had higher responses than M-COCl in different congeners and were selected. For the purpose of consistency, Table A should be modified to list the individual monitored ions.

P 12 Sec 6b

The paragraph contains a major typographical error which makes the contents very difficult to be understood. The phrase "the internal standard" in the middle of the fourth line on the top of p 13 should read "the native standard", since the phrase "more specifically...." refers to the previous statement of calibration curves appearing at the bottom of p 12. In this way, the concentrations of the native PCDD/PCDF can be determined from the calibration curves. We agree with the use of stable isotopically internal standard and the procedures 1), 2) and 3) as the authors described.

In summary, the results reported here are reliable since the Brehm Laboratory is a reputable organization and Dr. Tiernan is respected in the scientific community. Like in any case of major environmental monitorings and surveys, compromises must be made for the sake of the scheduling, workload and cost. The present investigation is no exception!

Sincerely,



R. C. Lao, Ph D
Senior Scientist
River Road Environmental
Technology Centre

cc: M. Bumbaco
C. Chiu